DOCUMENT RESUME

ED 326 407 SE 051 766

TITLE	On-Campus Teaching Guide.
INSTITUTION	Lee County School District, Ft. Myers, FL. Dept. of Environmental Education and Instructional Development Services.
PUB DATE	89
NOTE	151p.; For related documents, see SE 051 767-777.
AVAILABLE FROM	Department of Environmental Education, Lee County Schools, 2055 Central Avenue, Ft. Myers, FL 33901 ($3.50).
PUB TYPE	Guides - Classroom Use - Guides (For Teachers) (052)
EDRS PRICE	MF01 Plus Postage. PC Not Available from EDRS.
DESCRIPTORS	Educational Objectives; *Elementary School Science; Elementary Secondary Education; *Environmental Education; Experiential Learning; *Interdisciplinary Approach; Learning Activities; *Outdoor Education; *Science Activities; Science Education; Secondary School Science; Student Attitudes; Teaching Guides
IDENTIFIERS	*Informal Education

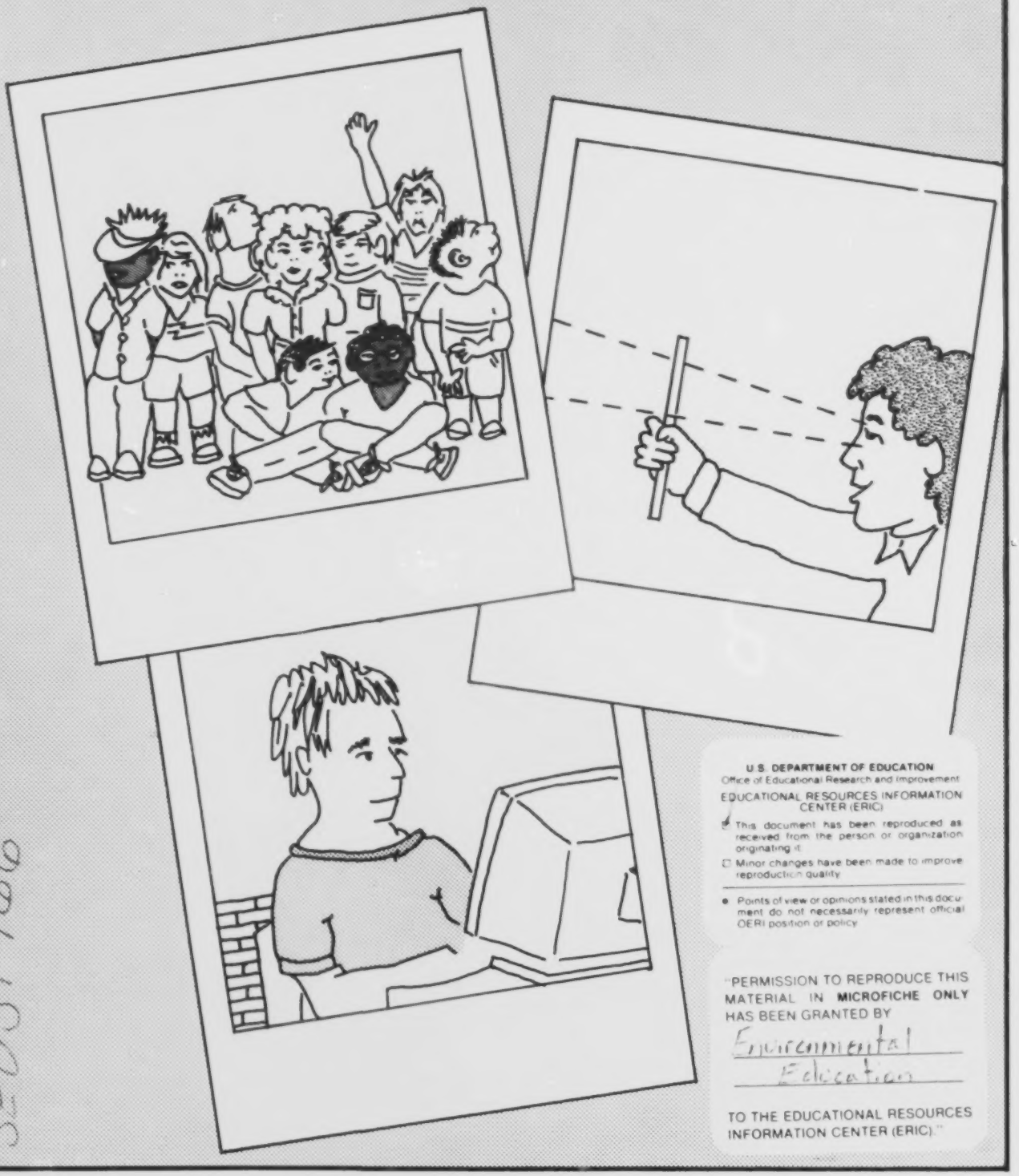
ABSTRACT

The environment encompasses all of the external and internal stimuli that affect people in their daily lives. How they are interpreted and how people react are as varied as the stimuli themselves. One of the major objectives of environmental education is to form positive reactions and attitudes toward the environment. The concepts and basic principles concerning the workings of the environment can be taught in backyards, vacant lots, off-campus field sites, or on the school campus. Since most children relate best to familiar areas, the school grounds are ideal for teaching environmental activities. This booklet presents a variety of environmentally oriented activities that can be used on school campus sites. Most of the activities are interdisciplinary and lend themselves to this type of teaching. The activities in this guide are cross referenced according to two separate systems: by discipline area and by topic and subject. Over 300 activities are suggested in this guide. (CW)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

ED326407

ON-CAMPUS TEACHING GUIDE



U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

☑ This document has been reproduced as received from the person or organization originating it.

☐ Minor changes have been made to improve reproduction quality.

• Points of view or opinions stated in this document do not necessarily represent official OERI position or policy.

"PERMISSION TO REPRODUCE THIS MATERIAL IN **MICROFICHE ONLY** HAS BEEN GRANTED BY

Environmental Education

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

SE051766

THE SCHOOL BOARD OF LEE COUNTY

2055 Central Avenue
Fort Myers, Florida

Colonel TedSan S. Timberlake
Chairman

Grace D. Bartleson
Vice Chairman

Mary M. Laurel

Suzi Martin, Ph.D.

Barbara Wallace

Karl Engel
Superintendent

Dr. Charles Godwin
Assistant Superintendent for Instruction

Dr. J. P. Lutz
Director, Elementary Education

Dr. William Hammond
Director, Environmental Education and Instructional Development Services

ON-CAMPUS TEACHING GUIDE

Illustrations and Graphics
by
Lawrence Getford

A publication of the Department of Environmental Education
and Instructional Development Services
of the Lee County Schools

PREFACE - TO THE TEACHER

Our environment encompasses all of the external and internal stimuli that affect us each day of our lives. How we interpret and react to these stimuli is as varied as the stimuli themselves. One of the major objectives of environmental education is to form positive reactions and attitudes toward our environment.

During the first five years of school, most environmental activities are directed toward a development of environmental awareness. The middle school years concentrate more on formation of knowledge concerning the environment or environmental problems. The high school years focus on environmental action.

The concepts and basic principles concerning the workings of our environment can be taught in backyards, vacant lots, off-campus field sites, or on the school campus. Since most children relate best to familiar areas, the school grounds are ideal for teaching environmental activities.

The school campus can be used on a day-to-day basis and should be viewed as an extension of the indoor classroom. Almost all disciplines can effectively use the campus as a teaching tool. By doing this, an essential step in building an awareness and knowledge base is made, and a more complete understanding of the off-campus field site can be obtained.

Children have been conditioned to associate the classroom with work and the outdoors with play. Repeated use of the outdoors as a teaching medium will serve to overcome the "conditioning" of viewing the outdoors solely as a playground. A degree of patience and a more firm hand than usual may be required for the first few outdoor assignments. Use large group activities first, and then gradually work into individual activities or small group activities.

This booklet presents a variety of environmentally oriented activities that can be used on school campus sites. Most of the activities are interdisciplinary and lend themselves to this type of teaching. By using your own creativity, you should be able to mix other disciplines with your own specific field.

HOW TO USE THIS BOOKLET

The on-campus activities in this booklet are cross referenced according to two separate index systems: (1) by discipline area and (2) by topic and subject. The teacher desiring a class activity which deals with art, language arts, etc., would turn to the "INDEX OF ACTIVITIES by DISCIPLINE AREA". Each activity is individually numbered. Those numbers in the index which follow the discipline title are activities in the booklet which relate to that discipline.

A teacher who wishes an activity relating to "ants" or an activity which encompasses a specific concept such as "change", would turn to the "INDEX OF ACTIVITIES by TOPIC and SUBJECT".

Due to the extreme flexibility of many of the activities within this booklet, they are not designed for specific grade levels. The activities are appropriate for kindergarten, elementary, middle, and high school students. An activity directed toward elementary children may be modified by a creative high school teacher to satisfy the needs of a high school class. For many teachers, the activities will provide an idea which will generate an imaginative technique for teaching on the school grounds.

INDEX OF ACTIVITIES by DISCIPLINE AREA

Discipline Areas	Activity Numbers
Art	1, 9-10, 22-23, 26, 40, 46, 54, 56, 58, 60-80, 105, 165-166, 184, 189, 193, 221-222, 271.
Home Economics	221-222, 230, 295, 303, 305-306.
Mathematics	21, 57-58, 75, 123, 151-163, 199, 205, 207, 216, 221, 289, 299, 305-306.
Language Arts	1-12, 14-19, 23-25, 27-31, 33-35, 39, 46, 49, 53-54, 56-58, 67, 75-76, 78, 119, 164-192, 221, 261-262, 272, 299-300, 302, 304-307.
Science	1-4, 6-13, 15-19, 21-22, 24-26, 28, 30-46, 49-60, 65-67, 69, 73, 75, 81-150, 165-166, 180-181, 184, 188-189, 193-219, 221-288, 290, 292-295, 298-299, 301, 303, 305-306.
Social Studies	5, 10, 16, 18-20, 22-25, 29-32, 45, 47, 52, 54, 57-58, 63, 65, 69, 72-73, 75-76, 79, 106-109, 165-166, 181, 187-188, 191-192, 221-231, 260-292, 294-306.

INDEX OF ACTIVITIES by TOPIC and SUBJECT

Topic and Subject Areas	Activity Numbers - Sub-topics	
Acorns	76.	
Adaptations	animals under rocks, etc., 115-116; coloration 122; leaf variation 97; movement 133; tree shape 198.	
Age	84.	
Air Layering Plants	113.	
Air Pollution	See Pollution.	
Animals	See Adaptations; see Ants; see Birds; camouflage 22; 122; change 17; color 22; 122; decomposition 125; fear of 32; fish populations 245; food 123; food webs 237; habitat 43; homes 115-117; see Insects; Lincoln Peterson Index 242; 245;	make-believe 11, 26; mammal populations 246; movement 21; 255; 307; pantomime 25; plant utilization by 253; populations 116; reproduction 36; role playing 28; 31; scat boards 124; 246; soil types 126; sounds of 121; see Spiders; trees and 41; tracks of 119-120.
Animal Behavior	132; 145-146; 148.	
Ants	colonies of 141; food preference 142; larvae of 141;	math and 162; speed of 162; tracking of 143.
Ant Lions	134.	
Art	acorns 76; centerpieces 77; clouds 64; collages 69-73; 99; concept of change 65; distinguishing color 60; energy 73; flowers 61, 74; holidays cards 78; leaves 66-68; 99;	litter 72; 79; mobiles 75; natural tools for 63; plaster casting 68; pressed plants 105; sandspurs 70; seasons 193; seeds 71; spatter prints 67; textures 62.
Attitudes	See Awareness; see Feelings and Attitudes; see Open Ended Activities.	
Automobiles	percent of campus used by 269; plant stress and 108; trees and 109.	
Averaging	See Mathematics.	

Awareness Activities . . . . alike and unalike 12; alphabet 177; bingo and nature 54; birdnests 37; camping 221; clouds 64; colors 22-23; comparisons 181; concept of change 16-19; 65; density 1; dependence 15; 30; descriptive words 183-184; ecological relationships 42; faking nature 52; fear of animals 32; good and bad changes 18; habitats 43; imitating 28; improvisation of animals 11; 26; 307; improvisation of people 24; interaction of living things 13; 15; 30; invisible nature 10; large and small 14; leaves 27; light and plants 38; living and non-living 17; memory 6-8; miniature worlds 35; movement 21, 28, 307; music 80-81; nature books 189; nature challenge 51; nature discoveries 46; nature quiz 44; 53; 57; noise 31; observation skills 34; 39; 260; see Open Ended Activities our community's trees 45; pantomime 25; patterns 22; see Photography; plant names 49; plant society 45; presence of people 20; reproduction 36; scavenger hunt 58; seasons 193-194; shape 1; 5; site 2; 8; size 1; 5; 151; smelling 2-5; sounds 8-9; sound and hearing 2; 5; 8-9; 33; tasting 2; 5; temperature 1; texture 1; 5; 62; touch and inner feelings 2; 5; 7; 56; trash 47; treasure hunt 50; trees 39-41; 83; 174-175; trust walk 5; ugly and beautiful 29; use of paper 291; water pollution 228; wind 25; words and change 19.

Birds. . . . . behavior 145-146; 148; coloration 60; 122; feeding 149-150; houses 149; locating 147; math 161; nests 37; 148; pigeons 145; seeds for 96; 150; sketching 144; sounds of 121; sparrows 145.

Board Feet . . . . . 114.

Calories . . . . . 251-252.

Camping. . . . . 221; See Wilderness Survival.

Canals . . . . . 205-207.

Careers. . . . . relationship to building the school 305; school personnel 304.

Change. . . . . animal homes 117-118; chemical types 219; concept of 16; describing 19; evidence of people 20; examples of 65; faking nature 52; good and bad 18; living and non-living 17; 51; reproduction 36; trees 83.

Chemical Change . . . . . 219.

Cinquain Poetry . . . . . 166.

Classification. . . . . identification keys 232-234; leaf characteristics 101; leaves 66; petiole 101; plant keys 234; plant parts 92; pressed plants and 105; twigs 104.

Clinometer . . . . . 154.

Clouds . . . . . 64; 198.

Collages . . . . . 69-74.

Color. . . . . favorite 23; flowers 61; patterns and 22; plants 87.

Compass Directions . . . . . 227-229.

Compost Piles. . . . . 293.

Crickets . . . . . 140.

Decomposition. . . . . of animals 125; soil fungi 100; recycling and 287.

Density. . . . . 248.

Dependence . . . . . 15; 30; 115.

Descriptive Words. . . . . beauty 29; change 19; color 23; names 49; nature 183-184; onomatopoeia 33; plant identification 233; trees 39.

Diatoms. . . . . 254.

Dissolved Solids in Soils. . 212.

Economics. . . . . 215.

Electricity. . . . . See Energy.

Energy . . . . . art 73; calories 251-252; electrical use 292; environmental support systems 279; productivity 251-252; school energy model 301; usage 282-283; utilities 265.

Environmental Action Activities . . . . . air 268; animals 32; art 72-73; 79; automobiles 269; birds 149-150; buildings 275; 277; campus environmental news 187; 192; 270; 272; campus observations 260; change 18; clean-ups 273-274; community problems 302; composting 293; effect of canals 205; effect of wind 197; see Energy; energy usage 282-283; environmental quality 262; fern gardens 112; food waste 295; health 278; see Land Use; litter 47; 267; 284-285; natural resources 266; noise 280-281; see Open Ended Activities;

(Continued)

Environmental Action Activities (Continued). . pine tree nursery 111; plant propagations and plantings 113; playground equipment 276; posters 271; puppet shows 191; recycling materials 287; 294; recycling paper 286; school cafeteria 303; school problems 299-300; support systems 279; surveys 261-265; 267; T.V. 272; transportation 264; utilities 265; 282-283; video tapes 270; water pollution 288; water usage 282; wildlife 263.

Erosion. . . . . 206-207.

Evaporation. . . . . 200-201.

Feelings and Attitudes . . . See Awareness beauty and 29; destroying living things 30; fear of animals 32; feeling large and small 14; improvisation and leaves 27; noise 31; sounds 33.

Ferns. . . . . 112.

Fertilizer . . . . . 214.

First Aid. . . . . 222; 278.

Flowers. . . . . see Awareness 61; 105.

Food Webs. . . . . building 238; campus collection of 240; evidence of feeding 237; interdependence and 235; mangrove 239; producers and consumers 236.

Fungi. . . . . 100.

Games. . . . . animals 11; 26; 28; 31; beauty 29; bird nests 37; change 16-17; color 23; descriptions 42; 49; 52; 72; habitats 43; improvisation 24; kite flying 59; leaves 27; 48; litter 47; living and non-living 51; memory 6; 55; nature game 44; 53; 57; observing 46; 51-52; 54; odor 4; see Open Ended Activities; scavenger and treasure hunts 50; 58; similarities 12; 14; touch 7; 56; trees 39; 50; trust 5.

Geography . . . . . building materials and 290; hedges and 107; trees and 106.

Government. . . . . 45; see Environmental Action.

Graphing. . . . . See Mathematics.

Grass . . . . . 87.

Habitats. . . . . 43; 115-116; 260.

Haiku Poetry. . . . . 165.

Health. . . . . 278.

Heights . . . . . 152-154.

Humidity. . . . . 202.

Improvisation Activities . . animals and sticks 11; if I were a... 167; imitating animals 28; leaves 23; noise 31; pantomime 25; role playing 24.

Industrial Arts. . . . . buildings 275; 277; construction 159; 218; 275; countries 290; determining board feet 114; playground equipment 276; size 151.

Insects. . . . . See Ants; see Ant Lions; behavior of 132; census 129; crickets 140; decomposition 125; diversity 129; 131; galls 136; homes of 115-118; 138; leaf miners 138; leaf scale 135; leaf utilization 253; mole crickets 139; mosquitoes 137; movements of 133; 255; natural coloration of 122; populations of 116; 129; 134; 247; soil types 126; sounds of 121; weather and 117; 140.

Interdependence. . . . . animal decomposition 125; complaints from the environment 30; examples of change 65; food webs 235-238; habitat 115-116; interaction among living things 13; mosquitoes 137; nature quiz 43; non-living and living 51; plant dependence 15; producers-consumers-decomposers 240-241; reproduction 36; seasons 193; soil organisms 126.

Interrelationships . . . . . animal homes 117; community trees 45; concept of change 16; decomposition of animals 125; evaporation from leaves 89; evidence of people 20; examples of change 65; food webs 235-239; habitat 115-116; injured plants 85; insect galls 136; interaction among living things 13; mineral content of leaves 90; nature quiz 43; nature walk 41; noise 31; patterns and color 22; people who run schools 213; plant dependence 15; plant growth 82; plants and light 38; 86-87; plants and water 91; producer-consumer-decomposer 240-241; respiration of plants 88; seasons 193 soil fungi 100; soil organisms 126.

Keys for Identification. . . 232-234.

Land Use . . . . . in the neighborhood 297; school as a park 298; school grounds 296.

Leaching of Soils. . . . . 211.

Leaf Miners. . . . . 138.

Leaf Scale . . . . . 135.

Leaves . . . . . See Classification; see Plants.

Lichens. . . . . 103.
Light. . . . . color 60;
see Plants;
shadows 198;
temperature 196; 252.
Lightning. . . . . 199.
Like and Dislike . . . . . See Awareness.
Listening Ability. . . . . 8-9; 33.
Litter . . . . . classify litterbugs 285;
cost of 284;
interschool project 91;
measurement of 285;
noise and people 31;
survey of 327; 267;
trash collage 72;
use of paper 291;
used as evidence of people 20.
Mapping. . . . . automobiles 269;
birds 147;
habitats 260;
insect homes 117;
plane table and alidade method of 220;
plants and 103;
plant species and 257;
pollution and 260;
succession 256;
words and 188.
Mathematics. . . . . ants 162;
average 163;
birds 161;
board feet calculations 114;
clinometers 154;
density of living things 248;
Dice's method of estimation 243;
diversity calculations 249;
estimating distance 156-157;
estimating numbers 158;
food calculations 123;
geometry 156; 159;
graphing insects 135;
height calculations 152-154;
insect diversity 131;
leaves 99;
lightning and distance 199;
Lincoln-Peterson Index for estimating 245; 247;
see Mapping;
see Measurement;
measuring pace 155; 157;
number quiz 44;
see Open Ended Activities;
percent organic matter 216;
percent of slope 207;
pollution 160;
population estimating techniques 243-245
proportion 152-153;
rain calculations 203;
rate of movement 21; 162;
sandspurs 163;
sets 161;
shadows 152;
shapes 159;
size 151;
water volumes 205.
Measurement. . . . . angles 154; 156;
animal populations 243; 245; 247;
density 248;
diatoms 254;
distance 155-157;
diversity 249;
evaporation 200-201;
height 152; 154;
lightning 199;
see Mapping;
see Mathematics;
movement of water 205;
see Open Ended Activities;
organic matter 122; 215;
plant population 243-244;
proportion 152-153;
rainfall 204;
sets 161;
shadows 152;
size 151;
soil compactness 208;
using indirect methods of 155-156; 158.

Memory . . . . . 6; 34; 55.
Mineral Content of Leaves. . 90.
Mini-Climates. . . . . 201.
Mini-Deserts . . . . . 259.
Mobiles. . . . . see Art; 75.
Mole Crickets. . . . . 139.
Mosquitoes . . . . . 137.
Mosses . . . . . 103.
Music. . . . . 9; 80; 81.
Observation Skills . . . . . See Awareness;
change 16-18; 52; 65;
clouds 64;
color 22-23; 46; 54;
dependence 15;
energy 54;
habitats 43; 260;
imitating animals 28;
insect homes 115-116;
living and non-living 51;
matching things 42; 54;
memory 6; 34; 55;
names 49; 54;
odor 3-4; 46;
see Open Ended Activities;
overcast days 198;
people 20; 29;
plants and light 38;
pollution 260;
reproduction 36;
seasons 193-194;
shapes 46; 54;
similarities and differences 12; 14; 35; 52;
sound 8-9; 33, 80-81;
touch 7; 46; 54; 56;
trees 39; 41; 50.
Onomatopoeia . . . . . 33.
Operational and Non-operational Definitions . . . . 180.
Pantomime. . . . . 25; 28.
Patterns . . . . . and colors 22;
leaf pictures 69;
leaf prints 67;
leaf veins 66.
Percolation in Soil. . . . . 211.
Pigeons. . . . . 145.
Plants . . . . . age 84;
air layering 113;
see Classification;
color 22;
communities 45; 258;
decomposition 100;
density of 248;
dependence in 15; 30;
diatoms 254;
Dice's Method of estimating populations 243;
diversity of 249;
evaporation from 89;
fern gardens 112;
fertilizer 214;
gall insects and 136;
games using 48-50;
geography and 106-107;
growth of 82-85;
habitats of 43; 82;
home made soils and 217;
identification keys for 233-234;
injury to 85;
insect utilization of 253;
leaf miners 138;
leaf scale insects and 135;
leaves 66-67; 69; 78; 89; 97;
light and 38; 82; 86-87;
mineral content 90;
parts 92;
pine tree nursery 111;
pollution 108;
pressing of 105;
reproduction of 36; 113;
respiration of 88;
seeds 71; 93; 132;
seed dispersal 94-96; 134;

(Continued)

Plants (Continued). . . . . shape of trees 98; sidewalks and 110; smells and 3; society 45; soil compactness 208; soil particle size 209; soil tests 213; space of 250; succession 256; surveys of 102; 257; transect studies 244; see Trees; variation in 99; water dependence of 91; see Weeds.

Playground Equipment . . . . 276.

Pollution. . . . . air 268; art 72; automobiles 269; campus observing 260; campus quality 271; 275; clean-up activities 273-274; effect of man 20; environmental support systems 279; games 47; health 278; litter amounts 285; litter bugs 285; litter cost 284; litter survey 267; noise 280-281; paper 286; plants 108; ponds 288; recycling 286-287; surveys of 261; 264.

Population Estimates . . . . density and 248; Dice's Method of 243; diversity and 249; establishing study plots for 242; of fish 245; of insects 116; Lincoln-Peterson method of 245; 247; scat boards and 246; space and 250; transect studies for 244.

Pressed Plants . . . . . 105.

Primary Productivity . . . . aquatic habitats and 252; leaf utilization and 253; terrestrial habitats and 251.

Producers-Consumers-Decomposers . . . . . 240; see Food Webs.

Proportion . . . . . See Math.

Protective Coloration. . . . 22; 60; 122.

Rain . . . . . 203-204.

Recycling. . . . . 276; 286-287; 293-294.

Relative Humidity. . . . . 202.

Reproduction . . . . . 36.

Rocks. . . . . 218.

Role Playing Activities. . . being a leaf 27; food webs 238; imitating 28; improvisation 24; mangroves 239; noise 31; pantomime 25.

Sandspurs. . . . . 70.

Scat Boards. . . . . 124; 246.

Seasons. . . . . 193-194.

Seeds. . . . . art 71; 76; dispersal of 94-95; math and 163; sidewalk cracks and 110.

Senses . . . . . hearing 1-2; 5; 8-9; 33; 46;
site 1-2; 8; 46;
smell 1-5; 46;
taste 1-2; 46
touch 1-2; 5; 7; 46; 56; 62.

Shadows. . . . . 152; 224; 228.
Shorthand. . . . . 186.
Similarities . . . . . 12; 35; 42; 49; 56; 83.
Size . . . . . 151.
Slope. . . . . 154; 207.
Soils. . . . . compactness of 208;
dissolved solids 212;
drainage and 204;
erosion 206-207;
evaporation rates 200;
fertilizer 214;
fungi 100;
how to make 217;
leaching from 211;
living animals and 126;
mini-climates 201;
organic matter in 215-216;
particle size 209;
percolation 211;
plant growth 82;
storm run-off 203;
testing 213;
water movement in canals 205;
water movement and particle size 210.

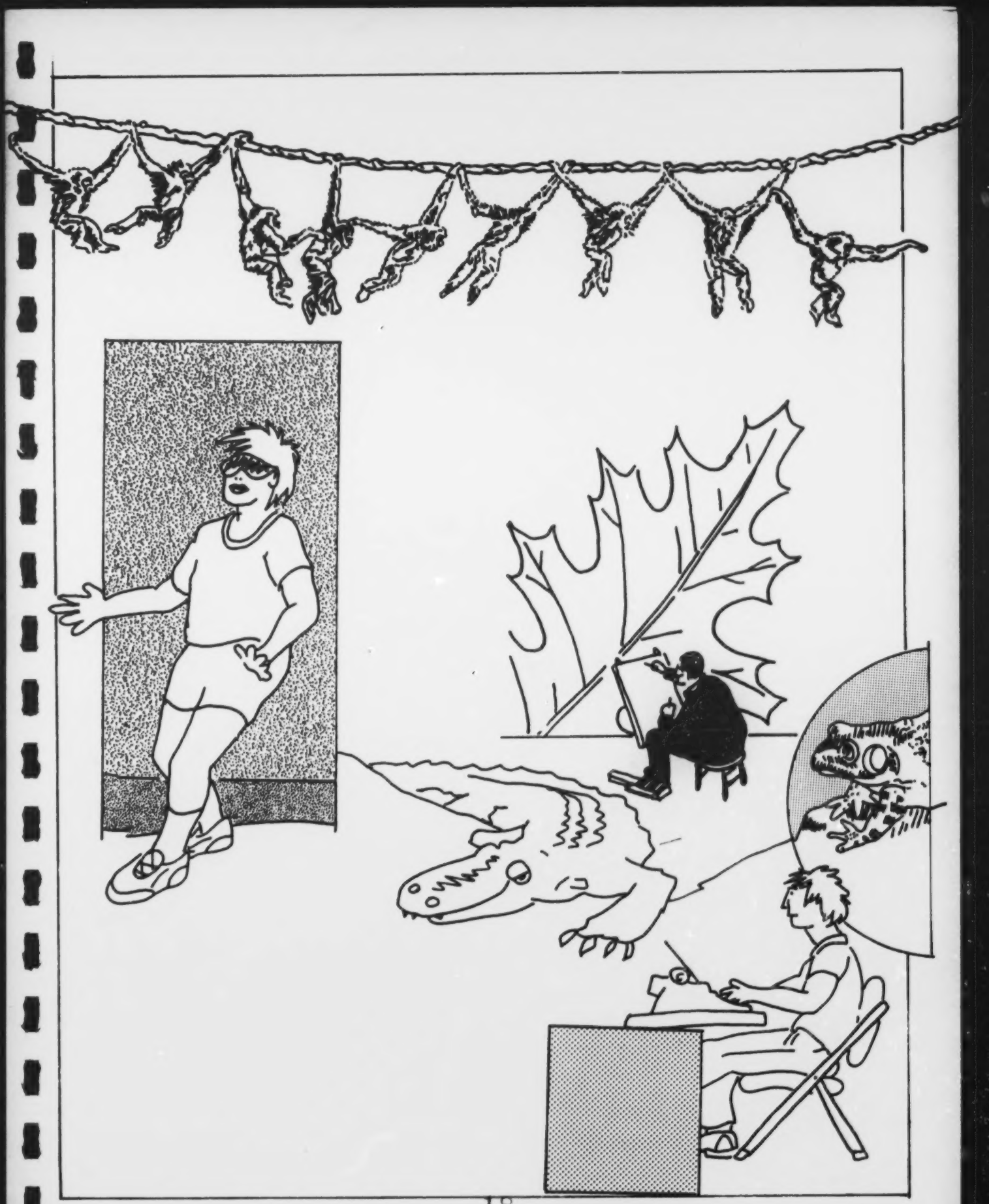
Solar Still. . . . . 231.
Sound. . . . . animals and 121;
awareness of 8-9;
music and 80-81;
source of 33.

Sparrows . . . . . 145.
Species. . . . . density 248;
diversity 249; 257;
space for 250.

Speech Therapy 185;
Spiders. . . . . 127-128.
Study Plots. . . . . 242; 247.
Succession . . . . . 256.
Sundial. . . . . 225.
Temperatures . . . . . 195-196; 259.
Textures . . . . . 61; see Senses.
Time . . . . . 224-226.
Touch Exercises. . . . . 7; 56.
Tracks . . . . . 119-120; 143; 223.
Traffic. . . . . bicycles 197;
people 289.

Transcets. . . . . 244; 246; 250.
Transportation . . . . . 264; see Automobiles.
Trees. . . . . age 84;
air layering 113;
automobiles 109;
board feet determinations 114;
see Classification;
communities of 45;
drawings of 40;
epiphytes on 103;
growth of 83;
habitats 43;
see Identification Keys;
interrelationships 41;
leaf evaporation 89;
mineral content of 90;
observations of 39; 50;
parts of 92;
see Plants;
respiration of 88;
shape of 98;
surveys of 102;
tree nursery 111;
twigs of 104;
variation in 97; 99.

Trust Walk . . . . . 5.
Typing . . . . . 2.
Weather. . . . . chemical change and 219; clouds 198; drainage and 204; effect on buildings 218; effect of rain 203; 206-207; erosion 207; evaporation and 200; insects and 117; 140; lightning 199; relative humidity and 202; seasons and 193-194; see Temperature; wind 197.
Weeds. . . . . art 77; see Classification; growth rates 85; growth requirements of 82; see Identification Keys; injury to 85; leaf evaporation from 89; leaf variation 97; 99; mineral content of 90; parts of 92; see Plants; pressing of 105; reactions to light 86-87; respiration of 88; seeds from 93-95; 163; sidewalk cracks and 110; surveys of 102; water dependence of 91.
Wilderness Survival. . . . . camping 221; compass reading 229; first aid 222; mapping 220; shadows 224; 228; solar stills 231; store bought wild foods 230; sundials 225; sun directions 227-228; telling time 224-226; 284; tracking and trail blazing 223.
Wildlife Inventory . . . . . 263.
Wind . . . . . directions and effects of 197; erosion and 205.
Writing Activities . . . . . aesthetics 164; add-a-line stories 172; alliteration 179; alphabet 177; anthropomorphism 174-175; comparisons 181; campus nature books 189; dependence 30; descriptive words 183-184; environmental messages 187; holiday cards 78; how would it be if 167; hyperbole 179; leaves 67; metaphore 179; missing words 171; nature plays 90; news programs 192; onomatopoeia 179; operational and non-operational definitions 180; poetry 165-166; puppets 191; reading readiness 176; riddles 255; science fiction 170; 173 shorthand 186; similarities 35; simile 179; 182; speech therapy 185; spelling 178; the furture 169; the miniature world 170; the past 168; trees 174-175; vocabulary 178; word maps 188.



1. ENVIRONMENTAL AWARENESS

Allow your students to discover objects relating to texture, shape, density, temperature, and size as they explore their school campus. Provide a work sheet using the following categories and words, with enough room for the students to write the names of objects that satisfy the words:

Size: heavy, thick, short, tall, small, large, narrow, big, little, miniature, etc.

Shape: oval, round, lobed, toothed, ridged, oblong, square, triangular, smooth-edged, pointed, curved, etc.

Texture: furry, hairy, waxy, knobbed, ribbed, soft, hard, slimy, velvety, coarse, slick, etc.

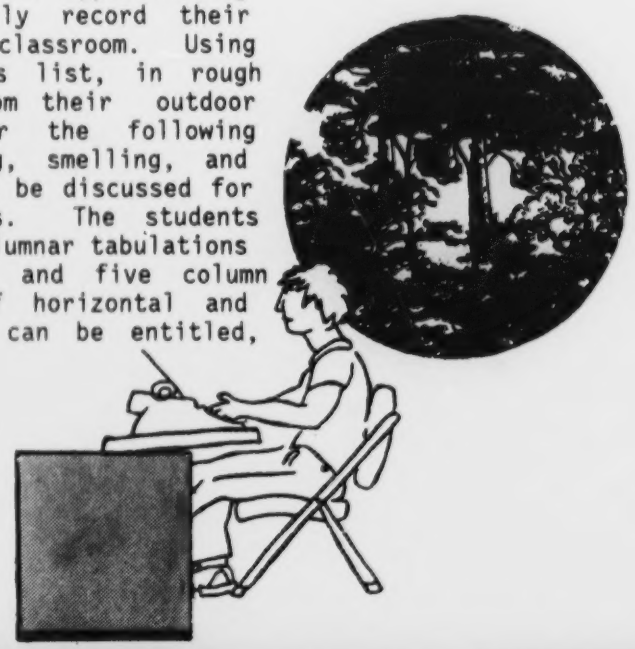
Density: solid, thick, lumpy, hollow, compact, spongy, porous, non-porous, etc.

Temperature: cold, hot, moist, wet, dry, clammy, damp, cool, lukewarm, etc.

How many of these words could be used in one square meter of the campus? How many could be used to describe a tree? A building? A sidewalk? A weed area? Younger students could each be given an example of something that could fit into the category of "smooth-edged" and a piece of drawing paper and asked to draw other things that fit into that category.

2. FIVE SENSES IN NATURE

Have your class go outdoors for approximately ten minutes to observe and mentally record their surroundings. Return to the typing classroom. Using their typewriters, have the students list, in rough draft form, what they can recall from their outdoor observations that would fit under the following headings: seeing, hearing, tasting, smelling, and feeling. The rough lists should then be discussed for additions, subtractions, and changes. The students should then proofread and calculate columnar tabulations for typing one, two, three, four, and five column typings. Stress the importance of horizontal and vertical balance. The final table can be entitled, "Five Senses in Nature".



3. TO SMELL IS SWELL

Lead your class to the most natural area you have on campus, one which is relatively undisturbed by people or mowing. Instruct students to smell as many flowers, plants, vines, and trees as they can. Before going outside, emphasize respect for living things with your students. Discuss with them the proper way of smelling a leaf. Show them how to rub the leaf, with the thumb and forefinger, to release the fragrance of the plant. Bend your head down to the plant to smell. DO NOT break off the plant and lift it to your nose. Teach the class to recognize poison ivy before going on the campus.

4. FOLLOW THE ODOR

Explain to your students that they are going to use an odor to follow a trail. Mark an "Odor Trail" a few minutes before class begins by rubbing a large onion on different campus objects such as trees, swing sets, and buildings.

5. TRUST WALK ACTIVITY

Take your students on a "Trust Walk". Each group should blindfold one person; the other group members should slowly lead this person around a section of the campus and explain what they see and feel. Give each person in the group a chance to be "blind", while the others do the explaining. Discuss the use of language and the art of communication with the class. Point out how descriptions help people identify and give meaning to objects.

6. NATURE MEMORY

This activity is designed to help students develop better short-term memory. Take your students outdoors and test their memory powers. Take a short walk around the school campus. As you walk, pick up small objects such as acorns, twigs, berries, etc. Place these items in a paper bag. Do not give reasons for placing the items in the bag. At the end of the walk ask the students what things they observed being placed in the bag. After completing this part of the activity, tell the students that you will repeat the activity. Did the class do better when they knew they were supposed to observe and remember what was placed in the bag? Could any students name all of the items? Discuss some techniques such as visualizing and note taking that help people remember.

7. TOUCH EXERCISE

This touch exercise can be used to increase students' descriptive skills and to reinforce their knowledge of plant characteristics. Before beginning the activity, discuss the types of things students should discover when touching an object. Place a branch from a tree or a specimen of a weed in a "touch box" (cardboard box with a hand hole and cover). Take the "touch box" to a portion of the campus where the plant occurs. Instruct students to "touch and feel" the plant gently. Ask them to locate it without having "seen" the specimen. A variation of this activity is to have your students divide into groups and search the school grounds for one object to place into a "touch box". Students attempt to guess each group's chosen object by feeling the item through an armhole in the side of the box. Utilizing several "touch boxes" or "bags", allow students to feel various objects selected by the teacher. With pencil and paper, students should describe the object by using one carefully chosen word (e.g. sticky, rough, sharp, etc.) and writing down what they believe the object to be.

8. SOUNDS AND EYES

Ask students how often they actually listen to the sounds they hear each day. How do we learn to identify sounds? Are there sounds we cannot identify? Divide the students into pairs and take them outside. Blindfold one person in each pair. Seat the students somewhere on the campus. Try to keep the pairs separated by at least 20 feet. No one should talk or make noise. After three minutes of quiet sitting, students should begin to keep track of the number of sounds they hear in the next three minutes. They should try to discriminate between different sounds. At the end of the listening period, discuss the sounds which were heard and identified. Was there a difference in the number of sounds heard by those who were blindfolded and those who were not? Is it possible to get a class average of the number of heard and identified sounds?

9. LISTENING AND SOUNDS

To help students develop listening ability, auditory discrimination, and auditory memory, take your class outdoors and have them keep a record of all the sounds they hear in four minutes. Draw pictures of the things making the sounds. Start a "round robin" discussion in which each student names a sound s/he heard. A sound may be named only one time. This activity will reinforce memory skills. Use the student drawings to make a bulletin board with the title "Campus Sounds".

10. INVISIBLE NATURE

Ask your students to work in pairs. Each student should be equipped with a pencil, some drawing paper, and a hard surface on which to write. Have each pair of students face each other sitting comfortably somewhere on the school campus. Ask them to take turns describing an object, such as a tree or bird or butterfly, which they can see from where they are sitting. As the one partner describes the object s/he sees, the other partner should sketch the object as s/he hears it described. Then switch roles, giving each partner a chance to sketch and describe. When the pair is finished, they should trade sketches and compare their sketches to the real objects. Was it easy to draw something which could not be seen? Discuss listening as a skill and discuss how observing specific characteristics can be important in learning about something or learning to identify something.

11. STICK THAT LOOKS LIKE AN ANIMAL

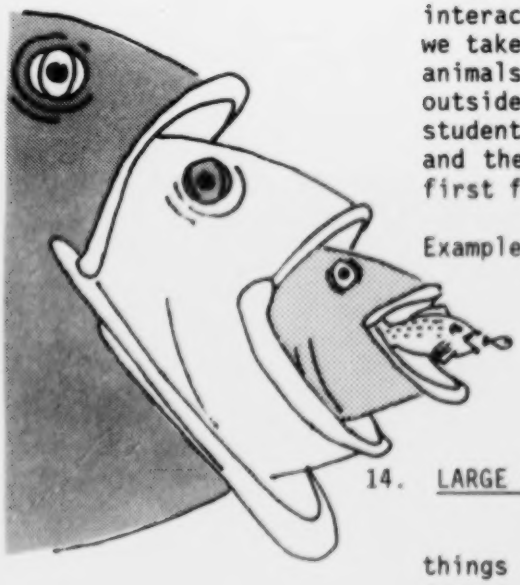
Ask students to find a stick that looks like an animal. When the class reassembles, have the students hold up their "animals", one at a time. The rest of the class should try to guess (aloud or in writing) what animal is being depicted. The person who is showing the stick should tell the characteristics which s/he associates with a particular animal. All animals have characteristics which identify them. Many of those characteristics can be noted through visual or tactile modalities. What are some characteristics that can be identified through these means?

12. ALIKE - UNALIKE

Discuss the use of categorizing to help organize information. Ask students if categorizing helps them to remember groups and individual things within the groups. Ask students to identify four different things on the school campus that can be grouped together by something they all have in common. Examples such as leaves are frequently chosen. Emphasize the idea of similarities to help group items. Show the differences that exist among the four items.

13. INTERACTION AMONG LIVING THINGS

No living thing exists alone, without affecting some other living thing. Discuss with your students how living things interact; e.g., a butterfly lands on a flower to get nectar, its actions cause the flower to be pollenated, then a bird may eat the butterfly. There are many examples of living things interacting with other living things. Indeed, each step we take upon the earth kills several hundred microscopic animals living in the soil. Have your students go outside and identify several living things. Have students write a list of five living things they can see and then list other things which can interact with the first five.



Examples:
1. bug - eats grass - gets eaten by bird
2. bird - eats seeds
3. grass - people, bugs, soil
4. shrub -
5. flower -

14. LARGE OR SMALL

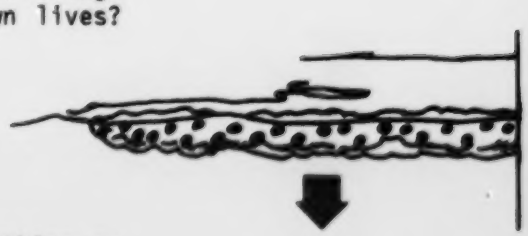
Discuss relationships or connections among things with the students. Divide the class into small groups. Give each student paper and markers. Lead the class to a secluded area on the campus. Ask them to sit very still and look and listen. Tell the students to write a paragraph describing whether the area makes them feel large or small, and why. Later, discuss what the students wrote.

15. DEPENDENCE

Some plants depend on other plants to help them thrive. See if your students can find any examples of plants that depend on other plants on your school's campus. Some examples of things to look for are: (1) air plants hanging on tree bark (the air plants are epiphytes, they do not harm the tree on which they are attached), (2) a strangler fig wrapped around a cabbage palm or other tree (it may or may not hurt the tree), and (3) mistletoe growing from a tree (mistletoe is a parasite, taking nutrients from the tree and harming it). When your students have located some plants dependent on other plants, have them sketch a picture of the two plants together and write a paragraph about how they think the two plants are interacting.

16. CONCEPT OF CHANGE

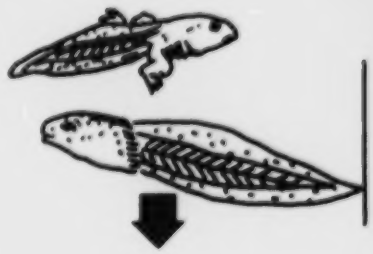
Work with the class to develop a definition of "change". Ask them to identify some things they know are changing. Can they name some things that are not changing? Ask students to prepare a list composed of two columns, headed: "What is changing?", and "How is it changing?". Allow the class to identify seven to ten items while walking about the school grounds, and place each within the categories. When the exercise is completed, ask students if it is important that things change. Can they identify changes in their own lives? What are the reasons for these changes?



17. CHANGE

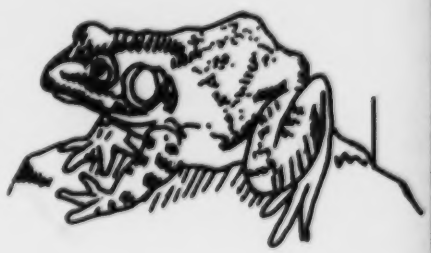
A.

Change is a continual process. Everything on earth is changing in some way. Some things change quickly and are easily observable, such as spiders building a web. Some things change very slowly and are noticed only over a long period of time, such as a small seedling growing into a pine tree. Ask your students to pair up and find evidence of things changing on the campus. They should be prepared to identify and explain the evidence of change.



B.

When we change things - things change. Discuss how people create change. Ask your students to cite examples of things people cause to change, e.g., we build houses and roads which change the way the community looks; we change clothes each day. Place the students in small groups and have them go out onto the school campus and look for signs that people have changed the environment. Students should record what they find and discuss the effects or results of those changes. Can people cause change which does not effect other things? Discuss why or why not.



18. POSITIVE CHANGES

Ask students to locate evidence on the school grounds of positive and negative changes. Students should be prepared to support their answers by noting the effects of the changes. Establish teams: one will make a list of positive changes and the other negative changes. After each team has made its list, a class debate can be held to consider whether the school has an overall positive or negative effect on the environment.

19. THREE WORD CHANGE

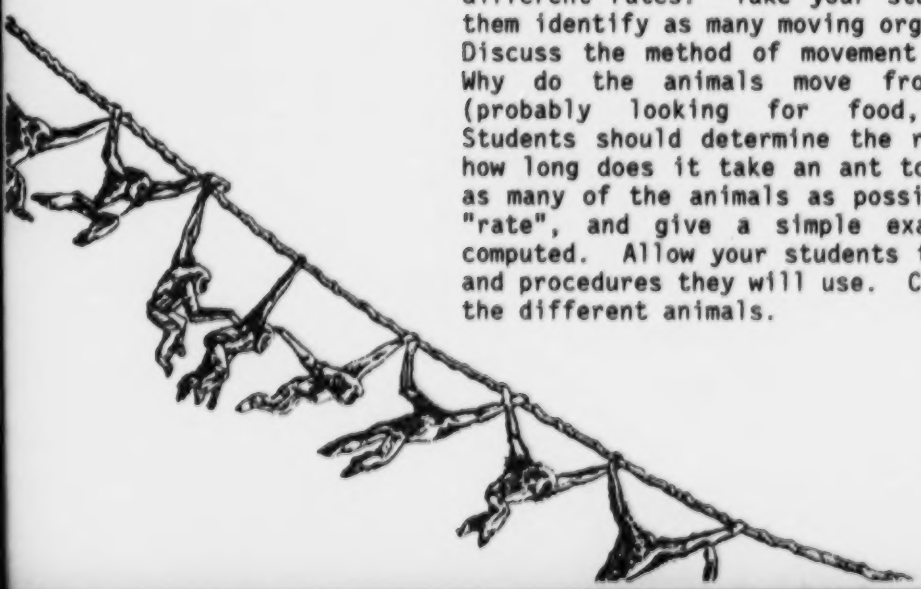
It is important for students to realize that actions always have a consequence. A change in the environment has a consequence, just as changes in values or changes in behavior do. Use the following activity to help students begin to see the consequences of change. Have your students locate things that have undergone change on the school grounds. The students should use three words to describe what they have seen. The first word should tell what the thing that changed was, the second word should explain what caused the agent of change, and the third word should either explain the result of the change or something else that was affected by the change. Read the word groups to the class. The class should feel free to argue about the words used. Examples: tree - fire - bark; animal - sticker - pain.

20. HAVE PEOPLE BEEN HERE?

On an undeveloped portion of the school grounds, students should find three kinds of direct or indirect evidence that people have been there. What sort of change occurred that led students to their conclusions? Encourage originality. Encourage students to find other evidences of human presence.

21. MOVEMENT

Movement is an important characteristic of animals. It allows them to search for food and capture it. Movement allows animals to seek a mate and flee from dangers. Animals move in different ways and at different rates. Take your students outdoors and have them identify as many moving organisms as they can find. Discuss the method of movement that each animal uses. Why do the animals move from one area to another (probably looking for food, shelter, or space)? Students should determine the rates of movement (e.g., how long does it take an ant to go 10 feet?, etc.) for as many of the animals as possible. Discuss the term, "rate", and give a simple example of how it can be computed. Allow your students to determine the methods and procedures they will use. Compare movement rates of the different animals.



22. PATTERNS AND COLOR

Stress with your class how all things have patterns and how colors can form patterns. Compare color patterns in the classroom: the green chalkboard; black or blue pens; the red fire extinguisher; etc. Outdoors, notice leaves are green, trees are brown, clouds are white, etc. Stress that everything has a color for a reason. Chalk is white or yellow so it can be seen on a chalkboard. Dark ink is used on white paper so that it can be seen. Red signals danger and helps to gain our attention. Outdoors, stress camouflage of insects. (Brightly colored insects can indicate danger to other animals.) Male birds are brightly colored to attract female birds. Leaves are green due to chlorophyll, which assists in photosynthesis.

23. FAVORITE COLOR

Color is one of the attributes which we use to identify or describe an object. Some colors are seen more often outside than they are seen inside. Ask students what colors are most frequently seen on the school campus. Is there a reason for the color being so prevalent? Ask students to declare their favorite color. They should write this color at the top of a piece of paper. Next, walk around the school grounds and have the students search for and list as many natural things as they can find which contain their favorite color. Search through the school or classroom for their favorite color. Is their favorite color found more often in man-made or in natural objects?

24. IMPROVISATION

Have your students research roles of different individuals such as land developers, environmentalists, commercial fisherman, Audubon Society members, and county commissioners, concentrating on their beliefs and thoughts about the environment. Have students write about the different roles and then act out different situations involving these people: a forest ranger confronting a group of campers who have littered the area; an environmentalist confronting a group of land developers; a commercial fisherman confronting a dredge operator; and a member of the Audubon Society confronting a county commissioner about zoning laws and population growth.

25. PANTOMIME NATURE

Creative expression can help students to identify with objects in nature. This process of identification can help students understand structure, function, etc. of any living or nonliving thing. Have your students pantomime the actions involved in planting a tree, building a bird nest, or trees moving in the wind. A hurricane, waves on a beach, a blossoming flower, a seed growing into a plant, animal movements, bees, flowers, mice, owls, trees, telephone poles, buildings, grass, soil, and air are all things which can be pantomimed. Instruct the students to act like the situations for the play acting: the day the sun didn't shine; the day there wasn't any water; the day the food ran out; the day when air pollution was bad; the day noise pollution was bad; the day people littered the area. Ask students what they learned by "being" something else.

26. MAKE BELIEVE

Visit a natural area and focus attention on the miniature life which abounds in a clump of moss or within the leaf blades of a lawn. Discuss the characteristics of the animals which live in these places. What characteristics do they have in common? What differences can be found? Ask students to use their wildest imaginations and to draw a picture of a make-believe animal or plant that might live in that place. What characteristics do the make-believe animals have in common with the real animals who lived in the location visited?

27. LIVING INSIDE A LEAF

Students could be asked to write a description that tells what it would be like to live inside a leaf.

28. WATCHING AND IMITATING

Instruct each student to find some living thing in the area and to watch it closely. When the class reassembles, each student should try to imitate the living thing observed, and the class should try to guess what it was.

29. UGLY TO BEAUTIFUL

Things or people who are different are often misunderstood or undervalued. Students need practice in valuing those things which are different. Take your class outdoors and give them the following instructions: Find some natural thing on the campus that at first sight appears ugly or not particularly beautiful. Examine the object closely and look for beauty in it. Describe the beauty you see. The descriptions can be oral or written. Discuss how this same principle can relate to people. Discuss what makes objects and people beautiful.

30. A COMPLAINING ENVIRONMENT

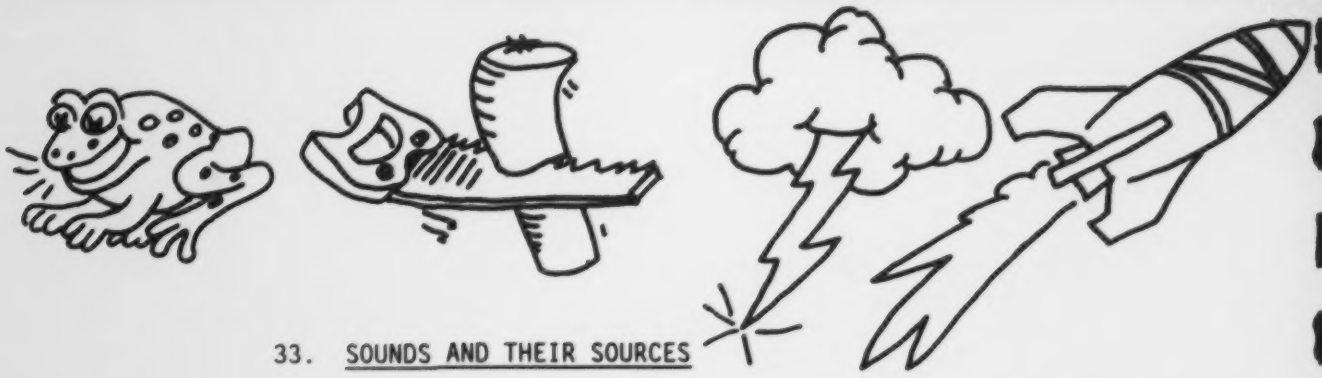
Discuss the meanings of "dependent" and "independent". Ask the students if some people are independent and some dependent. Is it possible that living things other than human beings are dependent and independent? Walk around the campus, having students note some living thing on which other living things are dependent. The students can write a short story or essay telling how the dependent organisms would feel and react if the thing on which they are dependent were destroyed.

31. NOISY INVADERS

As a follow-up to some of the aesthetic awareness exercises, ask students to describe in writing how they would feel if they were a plant or animal living on the campus and a bunch of noisy people came into this area.

32. WHO'S AFRAID?

Fear is often the result of lack of knowledge or understanding. Sometimes students do not know why they are afraid of certain animals. Have your students conduct a survey of other students. They should ask those surveyed if they are afraid of any animal. If the answer is yes, those surveyed should give a reason for their fears. Discuss the results of the survey. Look for reasons that are similar for different animals. Ask students to make reports on animals most frequently named as being feared. Share the reports with the class. Discuss methods which could be used to help people lessen their fears.



33. SOUNDS AND THEIR SOURCES

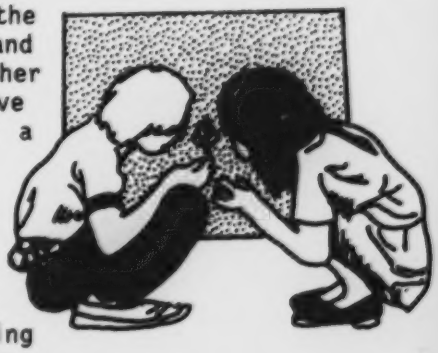
This activity is a good one to help teach the skill of making predictions. If the activity is repeated several times, students will learn that they make predictions based on observations and prior information. Students should visit the school grounds and listen for sounds. Instruct them to be very quiet as they listen to the sounds. Ask them to make lists of: (1) the sounds they hear (in descriptive words, e.g., "bang" - "buzz") and (2) the source of each sound. When each student has completed the lists, discuss how the sounds are similar and different. Which sounds are more pleasant than others? Why? Repeat this activity at the same time the next day. When students return to the classroom on the second day, ask them to make a list of what sounds might appear at certain times of the day and therefore be predictable? Did they hear sounds that will occur everyday at that same time? Ask them to make some predictions about the sounds. Ask them to write their predictions. Return to the campus several days later at the same time. Take the predictions. Which predictions proved to be true on this day?

34. OBSERVATION SKILLS

Before walking the class to a natural area on campus, give each student a piece of paper for recording observations. Choose any item, such as a tree, a flower, a spider in a web, etc. Instruct the class to observe the item for several seconds, remembering as much as possible, and making a mental picture of the object. Turn the class facing away from the object and instruct them to answer a series of questions about what they observed. Students may not turn to refresh their memory. An example of such questions that would relate to a spider in a web might include: How many spiders were there? In what portion of the web was the spider located: upper left, lower left, center, etc.? To what objects were the web "cables" attached? What was the dominant color of the spider? Students should write down the answers to insure full participation.

35. MINIATURE WORLDS

In class, divide the students into groups of two or three. Give each student a magnifying glass or hand lens and a 20 foot long piece of string or yarn. Take the students outside to a grassy area of the school campus and ask each group to lay their string on the ground to make a circle. Have each group, using hand lenses, search for tiny plants, animals, and other objects inside of their circle. After they have explored their territories, have each student write a story about the miniature world just discovered.



36. NEW LIFE ON CAMPUS

Have students find examples of young living things or clues that plants and animals are reproducing. Compose two lists, one for animals, another for plants. Common examples for animals are eggs of insects beneath boards, young spiders near webs, insect cocoons beneath the eaves, bird nests, etc. Plant examples may include the presence of seeds, seedlings, etc. Discuss the importance of the young plants or animals reaching maturity.

37. MAKING BIRD NESTS

Instruct groups of four or five students to construct birds' nests on the school grounds, using materials available to them from nature. The problems and complications will become evident to the children as they progress. Test the completed nests by seeing if they can be picked up from the ground. At the end of the activity, examine a real bird's nest, if you have one available. Be sure to remind the students that it is against the law to take a bird's nest from where it is located in a tree, or a shrub, on the ground, etc.

38. PLANTS AND LIGHT

Students should be instructed to look around the school to find examples which show that plants need light to survive. In other words, what would a plant look like if it had not received light. The students should not remove the plant from its environment, but should remember where it was seen. Students should be allowed to show others their examples. The person showing an example should be able to explain what deprived the plant of light.

39. OBSERVING A TREE

Use this activity to teach the skills of categorizing, observing, and reporting. The student writings can be used to reinforce any skill being taught in language arts. Review the skill(s) being taught and make sure students have writing materials before leading students to the "best" large tree on campus. Instruct the students to sit quietly on the ground facing the tree and to observe the tree for at least three or four minutes. After the observation time, students should number from 1-10 on their papers and beside each number write one word that tells something about the observation. When that part of the activity is completed, have students lie flat on their backs under the same tree and look up. After allowing the same amount of observation time, students should again write ten words relative to their observations. Ask students to group their words into three categories. You may give them categories such as shapes, colors, feeling, etc., or they can decide for themselves what categories are most appropriate for their words. As follow-up activities, discuss words that are similar and different in the two observation records and write a poem about this tree.

40. DRAW A TREE

This activity can teach students how leaves are attached to trees and something about why leaves are different sizes and textures. Give each student a piece of paper that has a tree <u>without</u> leaves drawn on it. Take the class outdoors to some favorite trees. Ask them to spend some time touching the leaves and observing how the leaves are attached to the trees. After the observation time, tell the students to draw leaves on their trees, trying to show what they have observed. They should decide what kinds of leaves they will use. A variation on this exercise is to draw a large tree on poster board. If you want to put real leaves on a tree for a bulletin board, allow students to collect leaves which have already dropped from a tree.

41. LIFE ON A TREE

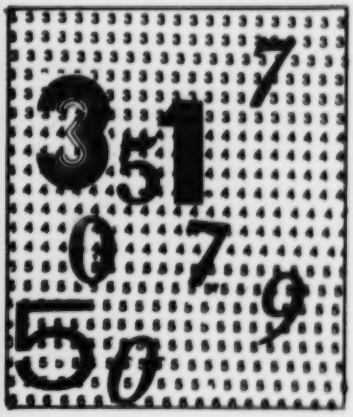
Students should look carefully around a tree and list all the animals and plants that are in, on, beneath, and around it. Back in the classroom, challenge students to see how many interrelationships they can explain. Why are ants on the tree? What does the tree do for the animals near it? Have students make charts showing the web-like quality of life in this small ecosystem.

42. LABELED WALK

Give each of your students a card that has an ecological relationship, such as, this is a home for a social insect or this is a plant that is dependent on another plant printed on it. For younger students, drawings and words can be put on the cards. After each student has his/her card, allow the class to go out on campus and find situations that demonstrate the concepts on the cards. Each student should place his/her card next to the object and then return to a common gathering place. Next, have students walk around the grounds and share their findings with the whole class.

43. HABITAT CARDS

Understanding that animals and plants live in a habitat, a place where needs for food, water, shelter, and space can be met, is an important concept for students to acquire. This concept will help students understand specifics about individual species. Understanding the concept will help students make decisions about their home area when they are able to vote. Give each student or small group of students a card that has a habitat statement typed or written on it. The students should find an area on campus that will satisfy the habitat conditions on the card. Some examples for cards would be: (1) Find a plant that provides food for birds, but this plant must grow in a sunny spot. (2) Find a place where animals could find food. When the students have located the plant, etc., ask them to review the conditions of the habitat.



44. NATURE NUMBER QUIZ

Mark off a specific trail or route for your students to follow on the school grounds. Place a piece of tape on the trees, shrubs, weeds, grass, animal homes, and other objects along a trail. Each piece of tape should have a question, two choices, and a number value for each choice. Students read the question and then select the right answer. The students should record the number value of their choice on a piece of paper taken with them. It is usually better to use odd numbers for the values so that no one can get the correct final number without getting all the questions correct. The total score should be compiled at the end of the trail. Then, go back over each taped item with the class. Examples of taped items would be: If this tree has a simple leaf, take 5 points; if this tree has a compound leaf, take 3 points. Another method of asking the question would be: What kind of leaf does this tree have? simple leaf - 5 points, compound leaf - 3 points.

45. PLANT SOCIETY

The idea of "community" implies a group of individuals who live in an area under similar conditions. The conditions determine the kind of life individuals lead. Have your students go to a campus area that has relatively natural growth on it. Weed patches in ditches or along fences would be appropriate. The students should imagine this area as a plant community or society. Students should compare this society with their own community. Is there any order to this society? What members of the society seem to be dominant? Are some members dependent on others? How are they dependent? Do communities in which people live have the same patterns of order, dominance, dependence, and independence?

46. MAKING DISCOVERIES AROUND THE SCHOOL CAMPUS

Instruct the class to make a list of the following items, or hand out work sheets complete with blanks for writing in discoveries. Have students locate each of the following items around the school campus. When they find the items, students should write or draw them to record their observations. Ask students not to collect any items.

1. Three simple shapes.
2. Something which is pleasant to see.
3. Something which is sad to see.
4. Something which smells unpleasant.
5. Something older than you.
6. Something younger than you.
7. Three different textures.
8. Three primary colors and two secondary colors.
9. A sign that an animal has been nearby.

47. POLLUTION SOLUTIONS

Litter has become a problem in many parts of the country. It is an eyesore and often becomes harmful to wildlife who may accidentally ingest or get caught in the litter. Have your students discuss where litter comes from and who is responsible for keeping litter in its place. Group your students in pairs or triplets and give each group an assignment. Have each group search the campus to complete its assignments.

Examples: two or three groups look for litter on campus
two or three groups look for sources of litter
two or three groups look for places where litter is collected on campus

When the students return to the classroom, have each group share its finds. Ask them to consider new ways they can encourage other students to keep the school and grounds clean.

48. LEAF RELAY

Dividing children into two or three lines, choose a leaf specimen for each line (preferably a soft, delicate leaf). At the word, "Go", students pass the leaf over their heads to the person behind them down the line. At the end of the line students turn and pass leaf back, this time between their legs. Catch! Leaf cannot be torn or wrinkled in any way. A piece of onion paper also works well.

49. NAME GAME

This game will help students remember individual characteristics of different plants, since the names they give plants will be based on specific characteristics they observe about the plants. Before taking students outside, set boundaries for the activity. Divide the class into four major groups. Send each group to a different area within the boundaries. Each group should compile a written list of ten descriptive plant names for plants in the area. The descriptive names will reflect students' observations of plant characteristics, e.g., pancake tree, wagon-wheel grass, sticker weed, pink flower, etc. After the lists are compiled, the groups exchange lists, and a different group is given the opportunity to recognize the plants by the descriptive names. Allow the groups to check each other. Discuss why the names were appropriate for the plants. If more than one name was given for the same plant, which name is most suitable and why?

50. TREE TREASURE HUNT

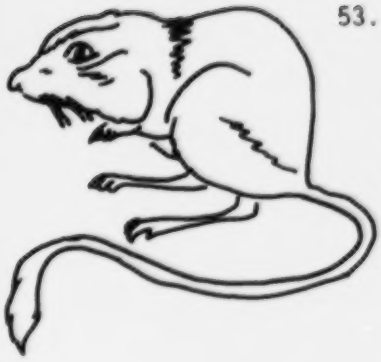
Introduce your students to the different kinds of trees on the school's campus through drawings, pictures, and by observations of campus trees. Once the students have been introduced to the different trees, set up a treasure hunt game. Use the trees that the students have been studying as landmarks. Hide objects around the campus, and give groups of students treasure hunt maps of the campus. In order to find the treasure, the children must be able to recognize the trees used as landmarks.

51. LIFE OR NOT

Discuss living versus nonliving with your students. Show them some examples of living and nonliving things. Divide your class into two groups and take them outdoors. One group should be designated as "nonliving" and the other group as "living". Each group will have 15 minutes to find and make a list of many objects that fit its heading. Items from one group can be challenged by members from the other group. When a challenge occurs, the challenged group must be able to find the object in less than a minute and explain why it's living or nonliving.

52. UNNATURAL TRAIL

This game is played primarily to introduce the concepts of camouflage (protective coloration) and adaptation. Choose a 40 to 50 foot section of trail and along it place 10 to 15 manmade objects. Some of them should stand out brightly, like flash bulbs or balloons. Others should blend with their surroundings, and therefore be more difficult to spot. Keep the number of objects you've planted secret. The students should walk over the section of trail, one at a time, with intervals between them, trying to spot (but not pick up) as many of the objects as they can. When they reach the end of the trail, they whisper in your ear the number of objects they saw. If no one saw all of them, tell everyone how many were seen, but that "there are still more". Then let them start over. End the game with a discussion of the ways camouflage coloration helps animals. Then go on a search for small camouflaged animals (insects, spiders, etc.).



53. NATURE 20 QUESTIONS

Take your students outdoors and have them play 20 questions. All questions must be answerable by yes or no. One student should select an object on campus and then the other students must guess what it is by using the yes/no format. Or, have a riddle session in which you or the students read clues about a plant or animal and the rest of the class tries to guess what it is. For example:

I AM AN ANIMAL WHO...

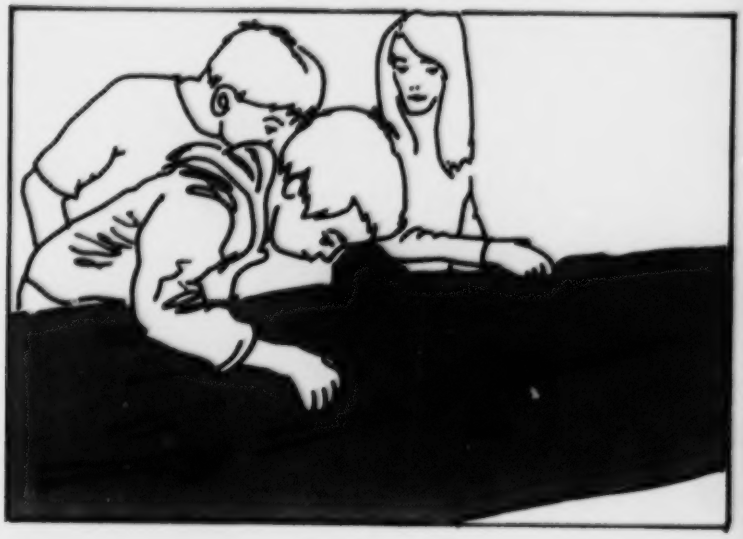
* does not like to live in cold weather.
* hatched out of an egg.
* had about 200 brothers and sisters at one time but most of them were eaten by other animals.
* has four strong legs.
* usually lives near fresh water.
* had a tail when I was young, but I don't have it any more.
* likes to eat all kinds of bugs.
* likes to hop and swim in the water.
* was called a tadpole when I was a baby.

I AM AN ANIMAL WHO...

* has thick brown hair all over my body.
* likes to eat all kinds of things - seeds, berries, insects, eggs.
* has a long bushy tail with rings around it.
* usually comes out at night to look for food.
* sometimes gets into people's garbage cans.
* has cute little hands with which I wash my food before I eat it.
* has a little black mask on my face that makes me look like a bandit.

54. FOOD WEB STORY CARDS

Make up a story about a food web and read it to your students. As you read, have each student listen carefully and circle on a "bingo" type card each plant or animal that is mentioned in the story. By the end of the story, every student should have completed his/her food web story cards. For example:



55. NATURE MEMORY HUNT

This activity can help you teach observation and reporting skills for science, mapping skills for social studies, and memory skills - good for every subject. Use the activity with a unit on plants or energy. Relate the items to be memorized to those used in your unit of study. Produce a display board with about 10 to 20 different items related to the unit and present on your school campus. Divide the class into groups of five or six. Give the class about two minutes to memorize the objects on the display board. Give each student a simple map of the campus. Explain to the students that they are to locate the objects on campus. Once the object is located, group members should draw the item on the school map. Set a time limit for the search and tell students where to meet you. Allow groups to exchange maps to check accuracy of the sightings. Which group had the best memory? Which group reported locations most accurately? What things can students do to help increase their ability to remember?

56. TOUCH AND FIND

Touch and Find is a tactile version of Nature Memory Hunt. It allows students to explore another sensory avenue that can help them remember. Give each student a map of the school. Place several items that can be found on the school campus in a large paper bag. Let each student reach into the bag and touch the items. Instruct the students to go out on campus and locate as many of the articles as they can. Be certain that no one looks into the bag until after the exercise is completed. Ask students why they had trouble finding some of the items and why they found others more easily.

57. TRUE-FALSE CHASE

Divide your class into two large teams. Line up each team so that they face each other and are about 10 feet apart. Designate one team as "true" and one team as "false". Approximately 25 to 30 feet behind each team establish a goal line with string or stakes. You should call out a true-false statement. If the statement is true, the true team must turn and run toward their goal line. The false team tries to catch members of the others team. If a capture is made, the captured person must join the other team. If the statement is false, the false team runs to their own goal line while the true team tries to capture them. Make up a series of questions that relate to subjects currently being studied. The following are examples, if you are "testing" their observations skills...

What a joy it is
to feel the soft, springy earth under my feet
once more,
to follow grassy roads that lead to ferny brooks
where I can bathe my fingers in a cataract of rippling
notes,
or to clamber over a stone wall into green fields that
tumble and roll and climb in riotous gladness!

- THE STORY OF MY LIFE by Helen Keller

58. SCAVENGER HUNTS THAT TEACH

Compose a scavenger hunt for the school grounds. Students should work in pairs to find the items and lists should be made and given to each pair of students. Collecting can be done if items are returned to their original places after the hunt. Lists can be of general nature or follow specific themes such as trees, shells, etc. The example which follows is a general list in poetry form.

NATURE SCAVENGER HUNT

Locate a pine tree somewhere in view
A pine cone from here is the first item for you.

Find one piece of burnt bark without being shown.
Next find one piece of litter and one small stone.

You're doing real well, now add one reddish leaf.
Next locate four thorns but don't be a thief.

Find a stick that you think looks like an animal;
Then find five small seeds from anything at all.

Collect a piece of Spanish Moss that has fallen to the ground.
Then find a dead leaf that makes a crunching sound.

Find a dead piece of fern that is brown to you and me;
Next pick one green pine needle from a living pine tree.

Don't give up now, you are almost through;
A feather of a bird is the last item for you.

59. KITES FOR SCIENCE

Making kites is fun for students of all ages. Have your students construct and fly this simple kite. Discuss the effects of lift and drag as well as other factors concerning flight. How does the angle of the string, mass of the kite, size, length of the tail, stability, etc. affect lift and flight? Younger students might simply learn about direction of wind and the fact that air lifts the kite. This kite is made from an 8 1/2 inch x 11 inch sheet of paper and uses sewing thread or fishline to hold the kite. Fold the paper as shown in the diagram. Clip off 3/8 inch from the front and back tips. Attach the bridle strings, flight line, and tail. (The bridle should be attached to either side of the wing with enough slack so that it can pass over the nose easily.) The tail should be 10 to 16 feet long and made of paper, cloth or string, but this will vary with wind conditions.

60. RAINBOWS

When discussing the properties of light and the light spectrum, use the outdoors. Give each group of students a small dish and a mirror. Fill the dish with water and place it near a wall that is in shadow. (The sun and wall should be in the same direction from the dish and about 10 to 20 feet away from each other.) Place the mirror at an angle, into the water as deep as the dish will permit. Two images should appear on the wall. The upper one will be a bright white reflection of the sun from the part of the mirror above the water. About 10 feet below this bright image, students should find a rainbow of colors. If students have difficulty in locating the colors, tilt the mirror so that the bright area is higher on the wall, and the colors should appear. Adjust the mirror until the colors are brightest. Discuss the properties of white light and the effects of a prism. Try different types of liquids (any transparent liquid). What happens to the spectrum? Discuss "structural coloration" in birds - which explains how all blue and green colors in birds are due to the reflection of this spectrum and not true pigment.

61. FLOWER COLORS

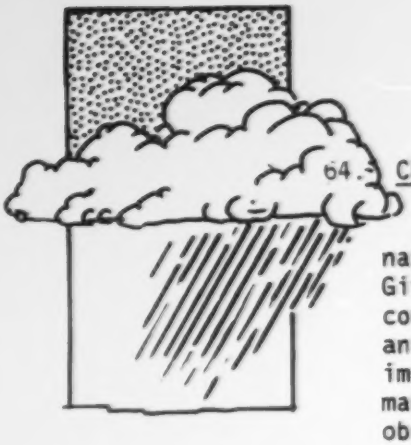
The earliest dyes, inks, and paints used by man were made from things in the environment - flowers, tree bark, fish, roots, charcoal, etc. Send your students outdoors to find different colored flowers. Students should take only one petal from each flower. Bring the different colored petals back to the classroom. By placing the petals on a white piece of paper, the color can be squashed out of the petals by drawing them across the paper. Students should make flower color designs of their choice. More advanced students can experiment with using inks or dyes made from bark or plant leaves.

62. TEXTURES IN NATURE

Hold a short discussion concerning textures and how they can be used in art forms. Then take your class outdoors and have your students identify as many different textures as they can locate. They should make sketches of each type. Include things such as different types of tree bark, grass, weeds, sand, different soils, leaves, etc. By getting as close as possible to these items and blocking out extraneous materials, the texture becomes an art form. Have students make charcoal or chalk drawings of their nature texture designs. It is interesting to put the designs around the room and allow the rest of the class to guess what texture is represented.

63. NATURE PENS AND BRUSHES

We did not always have felt tipped pens and modern brushes for communication. Earliest man scratched messages with rocks or bones. Allow each student to gather one item from the school grounds that could be used for a pen or brush. Small twigs, reeds, grasses, pine needles, thistle heads, feathers, burrs, flowers, etc. can all be used to give different effects. Have the students paint designs or pictures with their nature drawing tools. Record what tools were used at the bottom of each painting. Display the paintings in the school library or hallways.



64. CLOUD PICTURES

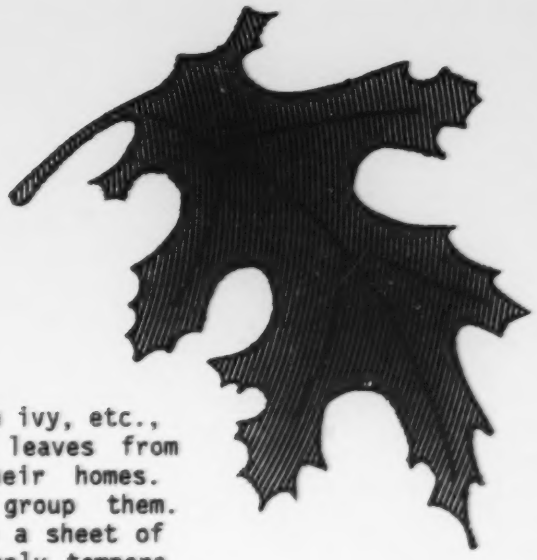
When studying weather, use the student's natural fascination to help you teach about clouds. Give each of your students a piece of dark or light blue construction paper and a piece of chalk. Go outdoors and observe clouds. Have students use their imaginations as they look at the clouds. They will see many interesting things formed during their observations. Use the chalk and construction paper to sketch what they are seeing. Construct a bulletin board of cloud pictures. Repeat the activity. Discuss the different kinds of clouds (cumulus, cirrous, etc.) and the times when they are most likely to be seen in Southwest Florida.

65. EXAMPLES OF CHANGE

Use this activity as a follow-up to class instruction concerning change or the interdependence of living things. Give students paper and a pencil. Instruct them to go outside and make drawings that will show any of the following: the interdependence of plants and animals; change; man's influence on his environment; a predictable change; positive and negative changes.

66. LEAF SKELETONS

Have one student collect a few fresh green leaves from the campus. Make a pounding board from a piece of old carpet tacked to a wooden block. Place the leaf on the pounding board veined side down. Hold the leaf firmly with one hand and gently tap the fleshy parts of the leaf with a fine-bristled hair or shoe brush. Brushes with animal bristles work better than those with synthetic bristles. Occasionally turn the leaf over and work on the underside until only the veins of the leaf remain leaving a "skelton". To preserve leaf skeletons, cement them to dark colored construction paper or cardboard. Label the leaf and cement a pressed specimen of the entire leaf next to the veined skeleton. Some students may wish to paint the skeletons and arrange them in pleasing patterns.



67. LEAF PRINTS

After warning students about poison ivy, etc., have them bring to class three or four leaves from weeds, grasses, trees, and shrubs at their homes. Discuss similar leaves and identify or group them. Arrange the leaves into pleasing patterns on a sheet of paper. Turn the leaves up-side down and apply tempera paint to the bottoms of the collected leaves. Place a piece of white paper on top of the painted side of the leaves and evenly press down. The leaf patterns will transfer to the paper. Spatter prints can also be made. Place leaves on a white piece of paper. Then spatter paint over the leaves and the paper. Use several different colors. Poems can be written about the leaf prints and attached to them. The completed prints and poems can be used to decorate the school.

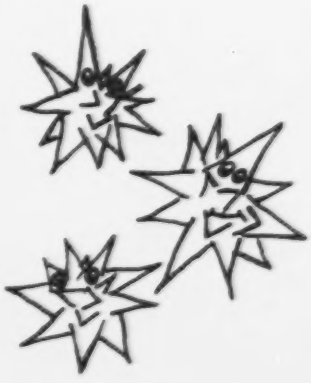
68. LEAF PLAQUE

Warn the students about poison ivy, etc., then have them collect a few leaves from the trees, shrubs, and weeds in their neighborhood and bring them to class. The class collection should show a great variety. Take students out onto campus to see which of the examples can also be found at your school. After this, explain that you will be making plaster casts of the leaves brought to class. Prepare a cardboard ring that is approximately 1 inch wide and large enough to encircle the leaf being cast. Grease the leaf with vaseline and place it vein side up on a piece of newspaper. Tie a piece of heavy string into a loop. Place the string loop into the cardboard ring so that half of the loop is outside the ring. This will allow you to hang the plaster cast on the wall. Now very slowly pour some Plaster of Paris onto the leaf and string loop. Fill the cardboard collar with the plaster. Allow the plaster to dry overnight. Remove the cardboard ring and peel off the leaf.. Gently wash the cast with warm soapy water. Paint the cast and the leaf print in contrasting colors.

69. NATURE ART

Make a class picture by allowing each student to gather one item from the school grounds (leaves, twigs, seeds, grasses, etc.). Compose the picture by gluing items onto light cardboard. Themes may be suggested by the teacher, or students may be allowed to follow their own imaginations.

Have students make leaf pictures or leaf collages from leaves collected. Collect small leaves from different areas of the campus. Allow the leaves to dry in a plant press or between paper towels weighted with bricks or books. Glue the separate leaves onto construction paper to produce wildlife or environmental scenes. A combination of seeds and leaves can also be used.

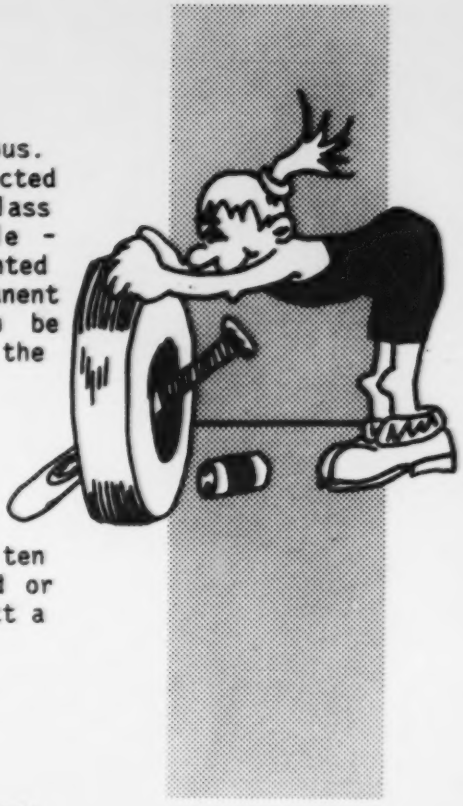


70. BEAUTIFUL SANDSPURS

Have your students collect sandspurs from the campus. Glue the sandspurs onto cardboard and then paint designs around them. Glitter can be sprayed on the collage to add highlight. A variation to this activity is to stick the sandspurs together to form spheres. Attach a string to each sphere. Use spray paint to spatter paint the sandspurs and then add some glitter. These spheres can be used as Christmas decorations or in mobiles.

71. MOSAIC NATURE PICTURES

Have students collect dried seeds from around the campus and identify them. Glue the seeds onto construction paper to produce mosaic pictures of wildlife and environmental scenes. The soft brown shades of the seeds can add to the decor of most homes and classrooms.



72. TRASH COLLAGE

Have your class collect trash from the campus. Allow the students to select pieces of the collected trash and construct a collage. Discuss with the class the dangers litter can pose to wildlife and people - from injuries or pollution. The collage can be mounted on plywood, beaverboard or masonite for a permanent classroom display. The resulting "pop art" can be titled, "Pollution -- Is It Necessary?". Dispose of the rest of the trash in a suitable way.

73. ENERGY COLLAGE

Have students go out on campus and collect ten objects that either show that energy is being used or was used in their making. Have the students construct a collage of their energy objects.

74. PETAL POINT

Have students produce petal point collages. Have students bring flowers from home. Identify the flowers. Are there any flowers of the same type on campus? Where are they located? What kind of care do they need? Do they require large amounts of water during Southwest Florida's dry season? Is there another type of flower which would require less water? Separate the petals and place them in a plant press or between paper towels weighted with books or bricks. This will allow the petals to dry, but retain their colors. Glue the petals onto construction paper to produce pictures.

75. NATURE MOBILE

Have each student collect five small natural objects from the campus - twigs, etc. Before constructing mobiles from these natural objects, discuss the purpose or role each object plays in the environment. The leaves should be press dried before use. The mobiles can be hung throughout the school before students take them home. Use natural objects or combinations of natural and manmade objects. A "Pollution Mobile" could also be constructed to demonstrate the differences between beauty and trash.

76. ACORN PEOPLE

Have your class go out on the school campus and collect acorns. If oak trees cannot be found on your campus, the students may collect pine cones or other seeds. Plant some of the acorns and pine seeds. Discuss the conditions needed for growth and the length of time it takes for the seed to become a tree. Ask students why trees are so important. With the remaining items the students might construct models of people using acorns for heads, sticks for bodies, etc. Clothes can be made from leaves. A good, fast-drying glue will help the students during this activity. Faces can be painted onto the "acorn, pebble, or stick people". If the models are constructed to look like police, firemen, grocery store owners, etc., students can construct a city community. The models can be used to tell stories or create model towns.

77. WEED CENTERPIECES

Divide the students into pairs. Have each pair collect one type of on-campus common weed, especially one in seed. Ask students why weeds are important. Make a small table centerpiece. Display the centerpiece in the classroom or school lunchroom.

78. LEAF HOLIDAY CARDS

Have each student collect three or four small leaves from the campus. They should place the objects on a folded piece of construction paper, making a picture. Place contact paper over the leaves and press down firmly. The contact paper will hold the leaves in place. Appropriate holiday verses can be written on the card before applying the contact paper. Arrange the leaves according to the holiday for which the cards are being made.

79. PAINT A CAN

Trash cans are almost as unsightly as the litter put into them. If your principal agrees, divide your class into small groups. Give each group a trash can, some brushes, and paints in several colors. Have a trash can decorating contest. Involve the entire school by letting them vote for the trash can of their choice. Distribute the cans throughout the campus. Allow the students to make a litter survey of the campus. This will help them place the cans in the most needed areas.

80. NATURAL MUSIC

Have your class go outdoors and allow each student to find one object which can make sounds, such as stones, seed pods, sticks, dry grass, etc. Discuss the sounds and "music" made by these objects in their own habitat for those who listen carefully. Do the sounds serve any functional purpose? Use these objects to play songs. If possible, compose your own music and allow your class to play at a school assembly.

81. INSECTS AND MUSIC

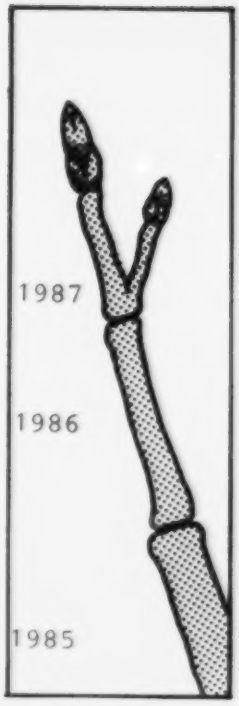
Take the class outside to a weedy area. Students should listen to insect sounds, find the insect and determine how the sound is produced. Then they should determine what instrument most resembles the sound and method of sound production. Have the class compose a song containing these sounds.

82. PLANT REQUIREMENTS

Review the basic life requirements of plants: sunlight (food), soil, water, and oxygen for roots. Have students take a survey of the areas on the school grounds where plants do not grow. Determine which of the major life requirements for plants is missing. (Bare ground on paths or playground sites can be related to soil compaction, which reduces the necessary amounts of oxygen in the soil. Stress the importance of burrowing organisms, like earthworms, and plant roots to loosen and aerate such soils.)

83. TREES AND SEEDLINGS

Examine a mature tree on your school grounds and compare this adult tree with a young sprout or seedling of the same species. Sprouts should be found growing beneath or nearby the mature tree. Ask students to list (or discuss): (1) ways in which the juvenile specimen is similar to the mature tree; (2) ways in which the sprout is unlike the mature tree. Relate this to their own growth, resemblance to their parents, and genetics, in general.



84. HOW OLD IS A BRANCH

Have your students determine the age of tree branches on the campus. Starting at the tip of a branch, locate the terminal bud (the last bud on the tip of a twig or branch). Now move along the stem until the first bud scale scar is located. The scar completely encircles the branch and is the point where the last growing season's terminal bud was located. Usually, the distance between the bud scale scar and the terminal bud represents one year's growth. How old is the branch? In what year did the branch grow the most? Do other branches on this tree show the same growth pattern? How often does this tree compare with other trees? What could have caused more growth in one year than in another year?

85. INJURED PLANT GROWTH

Choose several of the same type of weeds on campus and allow small groups of students to study two or three of the plants. They should measure the height of the plant, record the number of branches, and make sketches of the plant. Now have students carefully remove different leaves or branches from their plants. Tag the plants with waterproof markers so that they can be identified later. Have at least one group remove the terminal bud area (see #85) of its plant. Make periodic checks on the plant growth and record any changes. How were the plants affected by the pruning? Try to repeat the exercise and determine if these changes are predictable or occur by chance only. Discuss the concept of pruning with the students. Have them find out when pruning is most often used by plant growers and why!

86. EFFECT OF LIGHT DURATION ON PLANT GROWTH

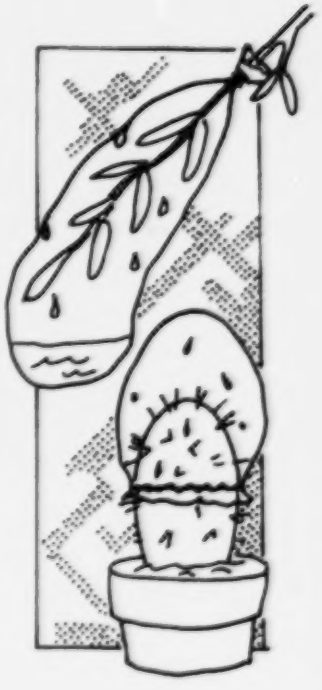
Have your students determine the effect of light duration on campus plants. Divide your class into five groups. Have each group of students choose a shrub with broad leaves for study. Have students cut small circles and triangles out of dense paper or cardboard. Take the students outside, equipped with their circles, triangles, and some paper clips. Record the condition of the study plants. Label one plant as "control"; this plant will be left alone. Have students very carefully paper clip the circles and triangles over some of the leaves of their plants. Leave the circles on the leaves for two or three days. After this two or three day period, have students remove some of the circles and record their observations. Yellow spots should begin to appear under the circle where sunlight cannot get to the leaf. Sunlight is necessary for green plants to make food. Discuss the results of the experiment with your students.

87. GRASS AND SUNLIGHT

Place a 12"x12" block of wood on top of some grass on an area of the campus. Choose a location which is not likely to be disturbed, which will not detract from the front campus appearance, and which can be revisited. Students should check the grass under the block every two days. The students can keep a record by using crayons to designate color changes that occur on each day. Discuss why the color changes. What will happen if the blocks are removed after a ten day period?

88. PLANT RESPIRATION

To demonstrate plant respiration to your students take them outdoors to a tree or shrub on campus. Place a clear plastic bag around the tip of one branch and securely fasten the open end of the bag around the stem. Fasten bags to several different plants. Water drops should form on the inside of the bags. From where does the water come? Which plants produce the most water from respiration? Which ones would survive best in a dry climate?



89. MEASURING LEAF EVAPORATION

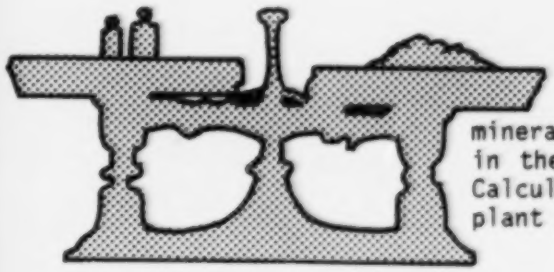
Select a leaf on a tree to make a "leaf sandwich"! Do not remove the leaf from the tree. To make the "sandwich", place a layer of plastic wrap on the top and bottom of the leaf with a strip of cobalt blue paper between the leaf and plastic wrap. Hold the entire "sandwich" together with paper clips. Check the leaf periodically and record the time it takes for the cobalt chloride paper to turn from blue to pink (dry to wet). Try several "leaf sandwiches". Compare different species of plants from different micro-communities, dry/wet sites, sunny/shaded, north/south sides of building. Record and list the data.

90. MINERAL CONTENT OF LEAVES

Have your students determine the percent of mineral content in different leaves from campus plants. During discussions and laboratory experiments concerning plant growth, students learn that plants use carbon dioxide, light energy, water, and soil minerals for growth. Have students collect 100 grams of leaves from each study plant. Also record the number of leaves necessary to make up 100 grams. Cut the leaves into small pieces and place each type in a separate flask. Using a burner, burn the leaves to an ash (if a kiln is available, place the leaves in the kiln for 24 hours at $600^{o}F$). Weigh the ash (the ash is the mineral material from the soil that the plant used). Use the following formula to obtain a percentage of mineral content:

Percent of Mineral Content =

$$\frac{\text{Weight of leaves - Weight of ash}}{\text{Weight of leaves}} \times 100$$



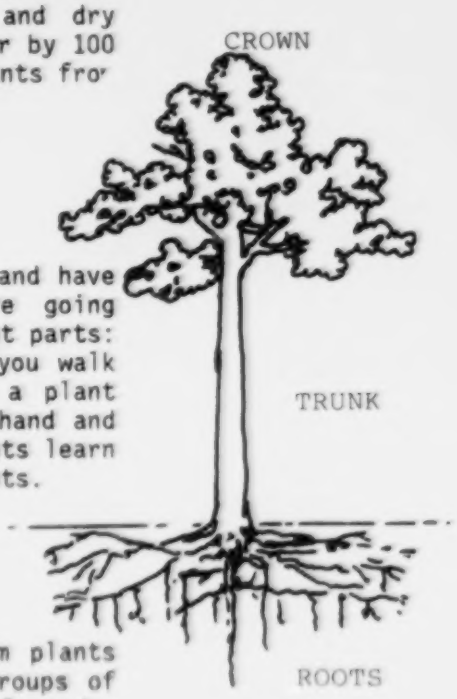
Did each species have the same percent of mineral content? What materials made up the most weight in the leaves: minerals or carbon dioxide and water? Calculate the total mineral weight of the leaves on the plant you sampled.

91. WATER DEPENDENCE IN PLANTS

Water makes up a large percentage of plant and animal matter. Plants, like animals, would die if water were not available to them. A general rule of thumb that can be used in ecological studies is that the percent of water content making up a plant or animal is a measure of water dependence for that organism. Have each group of students select a different area of campus from which to sample plants. Try to include dry areas, wet areas, and areas that show gradations between these extremes. Record on a campus map where the areas were, the relative wetness or dryness, abundance of vegetation, soil types, and types of vegetation. Have the students collect samples from the most abundant plant species from each study site. Weigh and record the weight of each plant then place the plants in dishes in a drying oven for 48 hours at 105°C. Weigh the dried sample and subtract the dry weight from the fresh or wet weight. Divide the difference between wet and dry weights by the wet weight. Multiply this answer by 100 to get the percent of water content. Do the plants fro the dry areas have more or less water content?

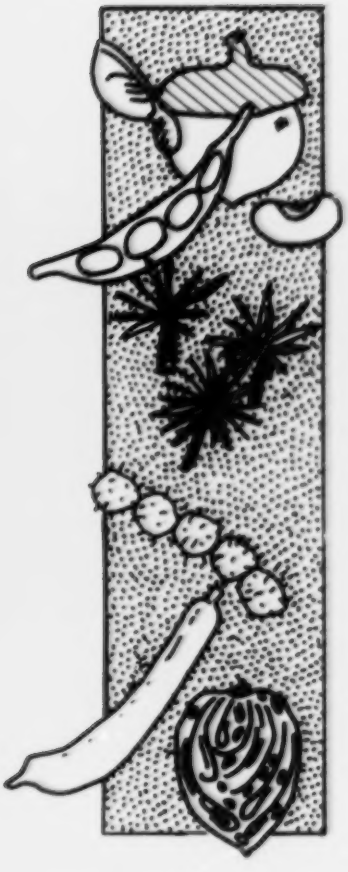
92. PLANT PARTS

Take your students out on the campus and have them identify the parts of plants. Before going outdoors, explain and point out the general plant parts: stems, branches, roots, leaves, and buds. As you walk around the campus, have random students name a plant part. The student must name a plant close at hand and point out the part named. This will help students learn the parts as well as the similarities among plants.



93. SEED AND PLANT MATCH

The teacher should collect seeds from plants found on the campus. Divide the class into groups of four and give each group two or three types of seeds. The students should then go out on campus and locate the plants that produced the seeds. This exercise will increase observation skills. A leaf from each plant can be collected and the matching seed and leaf can be taped to construction paper to make a bulletin board display.



94. SEEDS AND THEIR DISPERSAL

Divide the class into five or six groups. Each group should try to locate at least one type of seed. (You can always make a return trip if you do not have enough types.) Have students search the weedy areas of the campus for six different kinds of seeds. Then return and display the seeds, with the teacher leading a discussion on what seeds are and how each type of seed is dispersed (e.g., hitch-hiking spiny seeds, wind-dispersed feathery or winged seeds, bird-scattered smooth seeds, etc.). Have students predict what types of plants would be found in different parts of the campus according to dispersal methods.

95. WIND-DISPERSED SEEDS

Take the class on a campus walk. Find several kinds of wind-dispersed seeds. List the following forms of air travel on the chalkboard: propellers, gliders, rockets, wings, parachutes, balloons, helicopters, make the necessary form of comparison.

96. WHAT KIND OF PLANT DO BIRDS DISTRIBUTE?

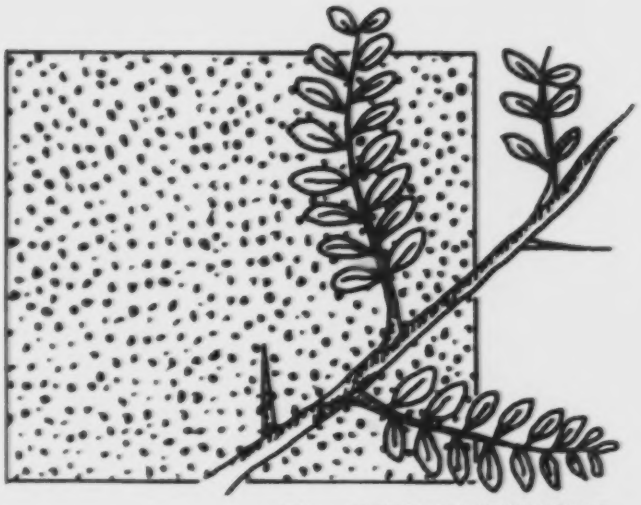
Obtain principal approval for this activity which teaches one method of seed dispersal. Stretch a pole, strong wire, or rope between two trees or poles. The pole or rope should be about 6 feet above the ground. Rake and smooth the soil under the pole or rope. Prepare a similar area without a pole or rope. This area is the control for the experiment. The pole or rope acts as a perch. Seed-eating birds will perch on the rope and the bird droppings will contain seeds. Compare the perch area with the control area after a few weeks. Keep both areas watered and tended. Keep track of when the first plants appear. Try to identify the plants and the type of seeds they produce. If there are plants in the control area, ask the students how the seeds got into the control area?

97. MEASURING THE LEAF AREA AND VARIATION OF LEAVES

Collect for your class 10 to 30 leaves from the same tree. Divide the class into groups of two or three. Give each group a leaf. With a pencil, have students trace the outline of their leaf onto some graph paper. Ask the students to cut all the whole squares inside the outline and the squares which are only partly within the outline. (A more accurate method is to estimate, with the use of decimal points, the percent of partially covered squares enclosed within the leaf tracing.) The teacher should list the class results in numbers of graph units covered by the leaf outline on the chalkboard. An average can be computed. Measure the true size of a graph unit and compute the actual size in square inches of the surface area of their leaf. Use this data to compute the amount of leaf surface on the entire tree. (If you told them that X amount of oxygen was produced over X period of time per each square inch of leaf surface, how much oxygen would be produced per leaf or per tree in a given day?)

98. THE SHAPE OF A TREE

Have your students locate various trees on the school campus that are oddly shaped. Try to determine what caused the tree to take its present shape. Trees near buildings often curve outwards due to lack of light, or become one-sided. Look for signs of pruning. Some limbs are destroyed by passing trucks and buses. Look for old wounds on the trunk and signs of terminal bud destruction (pine trees usually will have a shape curve in the trunk due to destruction of a terminal bud). Observe wound areas for signs of rot, and for signs of the bark growing over the wound. Have students record all the unique growth patterns of trees with injuries. Discuss how trees heal themselves and equate it to the human body.



99. STUDY IN VARIATION

Choose a shrub, vine, or tree which contains a compound leaf, a single leaf comprised of numerous small leaflets. Without picking the leaves, have each student choose several examples, counting the number of leaflets contained on a single leaf. Now the student should compute the average, or mean number of leaflets per leaf. Compare the results of the class samples with the results from individual students. Discuss which result is the most accurate and why. Other variations can be done with the number of flowers on a weed, thorns on a given length of vine, stickers, number of teeth on a leaf margin, etc.

100. SOIL FUNGI

Collect soil samples from different areas of the campus. Weigh one gram of soil from each site. Prepare 45 ml of sterile nutrient agar with a ph of 5. Divide the agar equally among five test tubes. Cool the agar of soil sample in tube #1. Mix thoroughly. Transfer 1 ml from tube #2 to tube #3. Continue this dilution technique until all tubes contain a soil and nutrient agar mixture. Now pour the contents of tube #1 into a sterile petri dish. Repeat this procedure for other tubes. Incubate the petri dishes for seven days in a warm dark place. The petri dishes now contain the following amounts of soil: Dish #1 has 0.1 g, dish #2 has 0.01 g, dish #3 has 0.001 g, dish #4 has 0.0001 g, and dish #5 has 0.00001 g. Count the number of different fungi and make drawings of each. Record color differences. Record the number of fungi for each dilution and calculate the total number per gram of soil. How do the different areas compare? Does the amount of organic matter affect the number of fungi?

SHAPE

101. GROUPING LEAVES BY A VARIETY OF CHARACTERISTICS

Reproduce the drawings, included with this activity, on handout sheets or have students copy them from drawings on the chalkboard. Ask students to locate, on the school grounds, trees, shrubs, weeds, or vines which demonstrate a simple leaf or the types of compound leaves in the drawings (or the type of classification being used). As a quiz technique, place specimens of the various leaf types around the room, each at a numbered station. Students proceed from specimen to specimen with their handout sheets and place each in the proper category. This and the related activities to follow prove to be excellent preparatory exercises to making a key to the trees. Preparing a scrapbook type of assignment and collecting from their neighborhoods an example of each arrangement, or as many as possible, makes an excellent homework assignment. Students will learn to identify and discriminate different types of plants by their leaves. Ask students to classify leaves using a variety of groupings.

102. PLANT SURVEY

Divide the class in groups. Students conduct and make a survey of all the kinds of plants on the school property. There is no need to identify the plants by name. List may read: four kinds of grass, two kinds of mushrooms, 10 kinds of trees, 12 kinds of flowers, etc. the group with the largest number of plants recorded within a given time limit may be declared a winner. Other groups may challenge for proof. Follow-up activities may work with identification.

103. MAPPING A TREE TRUNK

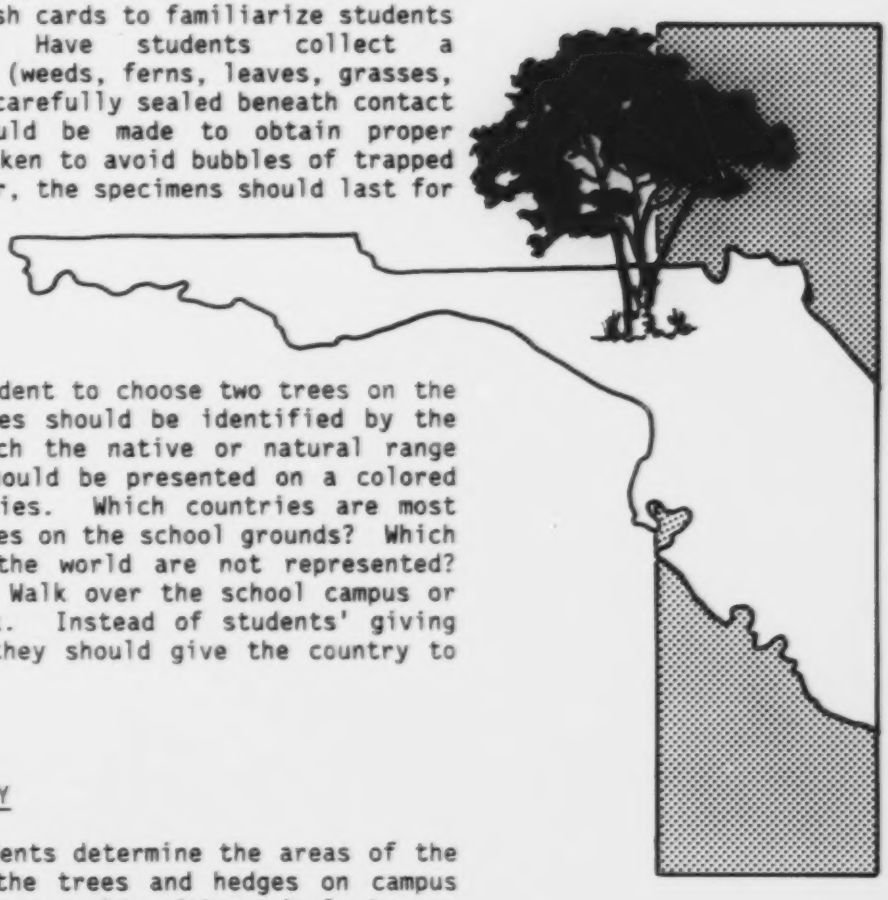
Making rubbings is an enjoyable way to teach students about the details of plants. It is an accurate way to record details without removing a plant from its habitat. Choose and mark with chalk, a 1 to 2 ft. high section of a tree trunk on the school grounds. Instruct students to make a map of this strip of tree trunk by making rubbings. Complete the map in sections so that these parts can be taped together forming one long roll representing the circumference of the trunk. Place the paper roll above or below the area mapped and compare the paper details of plants (moss, lichens, ferns, air plants, etc.) to the trees. Should anything be added? Mark any color difference in the trunk. Mark North, South, East, West; throughout the day define the zones remaining in shade. (The green tint to the shaded portion is due to the presence of the algae, Protococcus.) Discuss why the north side remains in the shade and the meaning of the Tropic of Cancer on the globe.

104. TWIG MATCHING

Part of the process of plant identification is the ability to match the twigs, bark, roots, and leaves of individual plants. Students learn to do this by practicing. Place several small twigs, which you have cut from living trees or shrubs on the school grounds, on four or five boards. There should be no leaves on the twigs. Twigs should be numbered (1,2,3,4,5, etc.). Place leaves from the trees used on separate boards. Number leaves A,B,C,D,E or place name beneath leaf. Do not allow students to study the leaf board. Divide the class into four or five groups. Students should be directed to the designated portion of the campus where the trees occur. Instruct the students to locate the tree from which the twigs were cut by identifying the twigs. After locating a match, the group picks one leaf from the tree to match the twig. Returning to the leaf board, students confirm identification and list on paper the proper combination of numbers to letters.

105. PLANT CARDS

This completed product can be placed around the wall or serve as flash cards to familiarize students with local flora. Have students collect a representation of plants (weeds, ferns, leaves, grasses, etc.). Each species is carefully sealed beneath contact paper and attempts should be made to obtain proper identity. If care is taken to avoid bubbles of trapped air beneath contact paper, the specimens should last for several years.



106. PLANT GEOGRAPHY

Allow each student to choose two trees on the school campus. The trees should be identified by the student who must research the native or natural range for the trees. This should be presented on a colored range map for each species. Which countries are most represented by their trees on the school grounds? Which countries or areas of the world are not represented? Give reasons for this. Walk over the school campus or grounds on a tree walk. Instead of students' giving the name of the tree, they should give the country to which it is native.

107. TREE AND HEDGE GEOGRAPHY

Have your students determine the areas of the world from which the trees and hedges on campus originated. Use a good tree guide with a simple key to the trees and one that tells where the trees originated. Study each country represented on your campus.

108. PLANT STRESS

Students should locate five or more examples on the school grounds where people have caused some stress or injury to local plants. Discuss the importance of plants to people as oxygen-producing agents. Older students may wish to consider the effect of stress on plants along driveways or at stop lights where idling buses and car exhaust cause plant damage from carbon monoxide entering leaf stomata and displacing oxygen. High schools may use infra-red film to recognize plant stress.

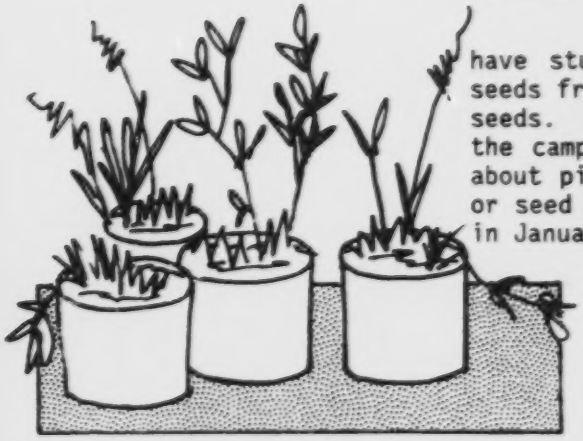
109. OXYGEN FOR YOU - OXYGEN FOR ME?

Emphasize with your class that green plants are the only source of oxygen on the earth. For every automobile that emits carbon dioxide into the air, 50 large healthy trees are needed to restore the oxygen that was used. The class should study the school grounds, working in pairs or small groups and count the number of cars in the parking lot versus the number of trees on the school grounds (small trees or shrubs should be counted only as fractions of a "large healthy tree"). Do the school grounds have an oxygen surplus or deficiency? How many more trees would be needed to create an oxygen balance? Discuss the added effect of cars driving past the school.

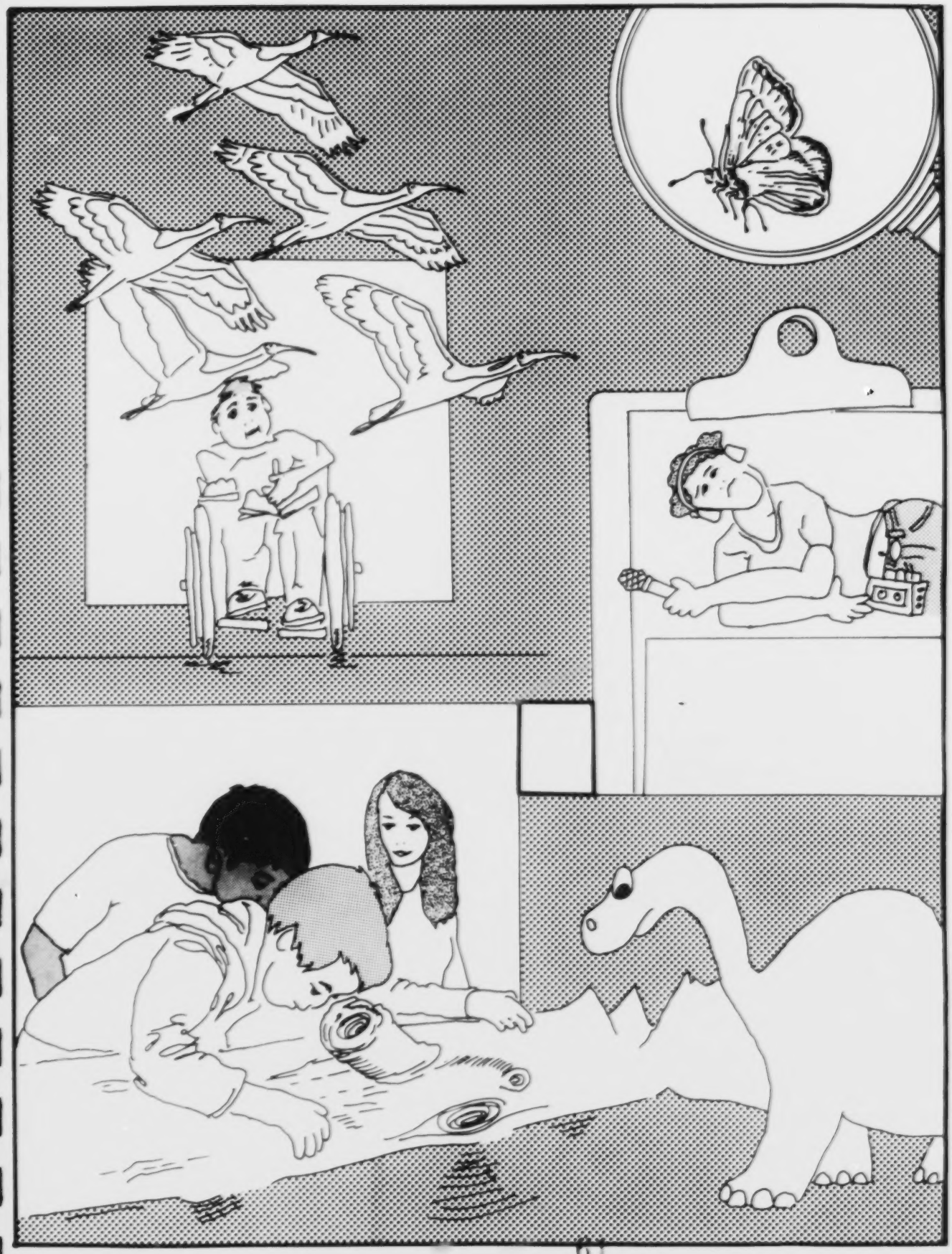
110. SIDEWALK SPROUTS

Find a sidewalk for this activity. Scrape the dirt out of several sidewalk cracks. Place this dirt in a small cup or a depression in an egg carton. Scrape dirt from different cracks along the sidewalks, keeping track of the sample locations. Label each container with the location from which the dirt was taken. Water the containers and place them in a warm, sunny area. Watch what grows! When the plants are 2 to 3 inches tall, carefully transplant them to larger containers or tin cans. More than one plant can be placed in a container. Be certain to remove any new plants that sprout in these new containers since they are not from the sidewalk crack, but from the new soil in the pot. How many different kinds of plants grew from the seeds in the cracks? Are there any plants from one location that were not found in other areas? Are any plants common to all locations? Try to find plants like those in your containers outdoors near the sidewalks. Look for seeds on these plants and try to determine how the seeds got into the sidewalk cracks.

111. PINE NURSERY



Collect pine cones from the campus trees or have students bring in pine cones. Remove the pine seeds from the cones. Prepare a soil bed and plant the seeds. Transplant the young trees to different areas of the campus. Invite a forester to speak to your class about pine culture. If possible, do the transplanting or seed planting on Arbor Day. (Florida's Arbor Day is in January; National Arbor Day is in April.)

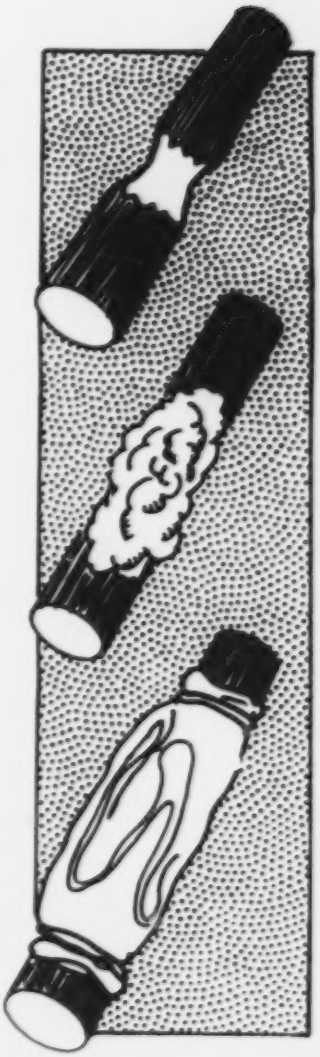


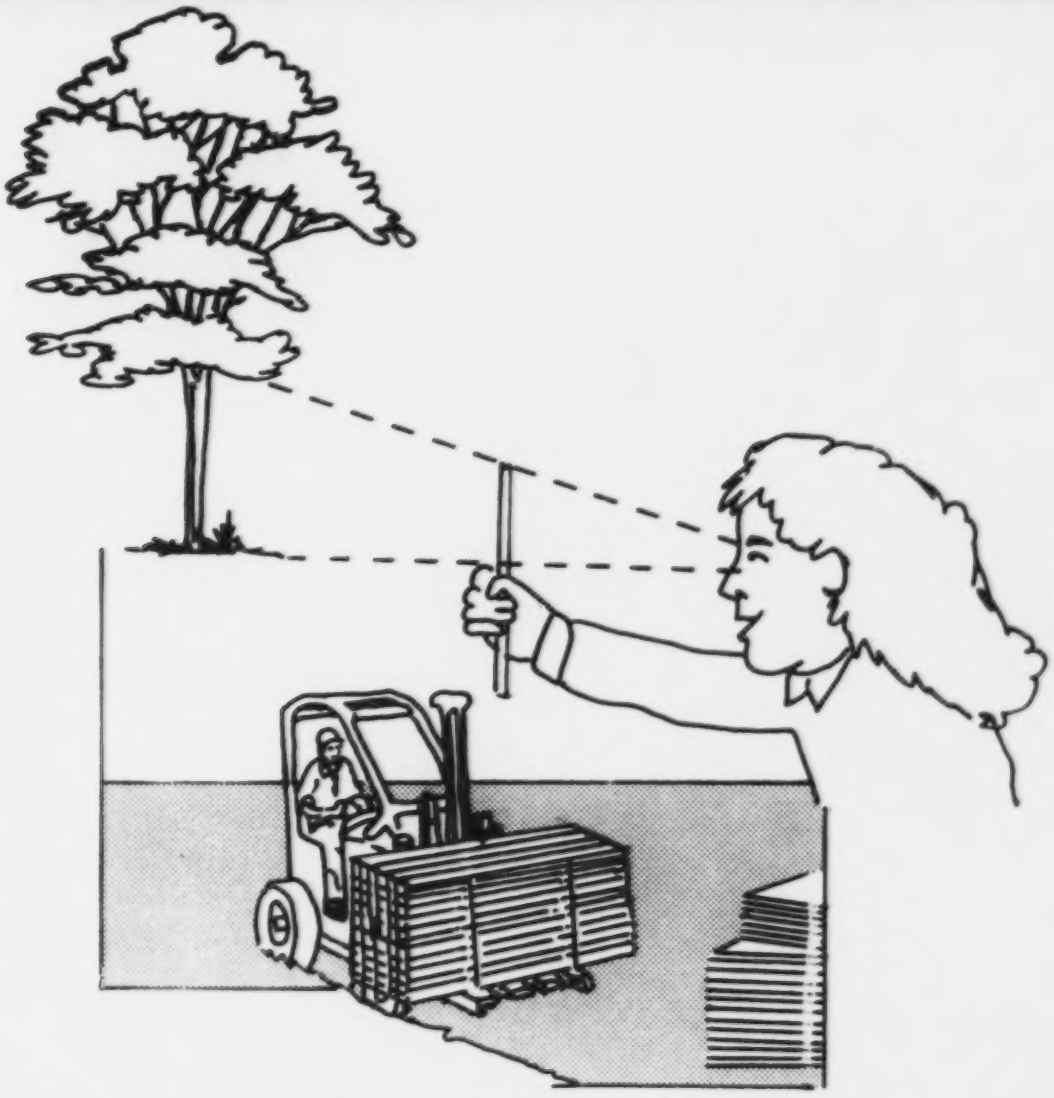
112. FERN GARDENS FROM SCRATCH

Have your students bring in a fern frond with sporangia on it. Try to get as many different types as possible. For each species of fern brought in, use the following procedure: Fill a shallow container half-full with small pebbles. Cover the pebbles with a mixture of sand and leaf mold. Cover this mixture with a thin layer of fine sand. Sterilize the container and its contents in an oven at high heat for 15 minutes or autoclave at 15 p.s.i. (pounds per square inch) for 15 minutes. Allow to cool and cover with a piece of glass. After cooling, add water until the soil and sand are moist. Sprinkle spores from the fern frond thinly over the surface. Replace the glass cover and incubate in a warm, shaded spot. In a few weeks microscopic heart-shaped prothallia will appear. In another week or so, small fronds will be seen. When the plants are about 1 inch tall, transplant them to a seed flat. After a few weeks, transplant the ferns to an outdoor fern garden. (This area should have plenty of decayed leaves and sticks mixed in with the soil.)

113. AIR LAYERING PLANTS

When discussing plant propagation, have your students choose trees and shrubs on campus which can be air layered. Air layering is a simple procedure. You will need a sharp knife, some sphagnum moss (obtainable from garden supply or nursery stores), and some aluminum foil. Cut a wide "V" shaped notch in the plant stem about one third of the stem thickness. A commercial product, called "Rootone", can be applied to the open cut. This will facilitate the production of roots. Surround the notch with well moistened sphagnum moss. Cover the moss with aluminum foil. Twist the foil tightly around the moss and stem so that moisture cannot escape. Allow the plant to remain this way for at least one month before checking for roots by gently unwrapping the foil. If roots are not present, moisten the sphagnum moss and re-wrap the foil. If roots are present, remove the foil and carefully cut the new plant from the parent plant. Put the new plant in the desired spot on campus. Be certain to dig a large hole for the plant. It is a good idea to add fertilizer and peat moss to the soil before planting. The following list contains some common trees and shrubs that can be air layered: Strangler fig, Cuban laurel, banyan, waxmyrtle, umbrella tree or schefflera, hibiscus, frangipani, and azalea. Hardwood trees, such as maples and oaks, cannot be air layered.





114. BOARD FEET IN A TREE

When discussing the importance of plants with your class go outside and determine the number of board feet of wood contained in campus trees. Determine the height of the tree from the ground to a point near the top where the tree is about 8 inches in diameter. (There are several exercises in this booklet that deal with estimating tree height.) Determine the diameter of the tree trunk 4 1/2 feet above ground (diameter at breast height). Next, determine the number of logs in the tree. A log is a section of the tree that is 16 feet long. Trees are cut into logs in order to haul them to the saw mill. To find the number of logs, divide the height of the tree by 16 feet. Finally, put your data into the chart to obtain the number of board feet. A board foot is a board 12 inches long x 12 inches wide x 1 inch thick.

115. WHO LIVES UNDER WHAT?

Have your class walk around the campus locating such things as rocks, boards, bricks, and other articles resting on the ground. The students should try to answer the following questions. How do environmental factors differ between the areas around the objects on the ground, and under the object? (Light, heat, moisture, protection for animals, etc.) How are the animals under the object adapted for this habitat? (Many are flat, some burrow in the soil.) How did the animals respond when the object was moved? What would happen if the object were left overturned? Why is it important to return the object to its original position? Thermometers can be used to determine differences in temperature. To check moisture differences, use the sense of touch.

116. SEARCHING BENEATH BOARDS

Make a study of the creatures under a piece of board or scrap cardboard. Be sure to return the board afterwards in order to preserve the habitat. How many different types of animals can you find? What reasons can the students give for the insects' living there? Make a chart showing population counts under the same board. Make a census once a week to compare numbers. Make up descriptive names for the creatures you find.

117. CAMPUS HOME WALK

Take your class outdoors. Have them walk over the campus in search of animal homes. List the types of homes found and mark their locations on a campus map. Return to these areas after a rainstorm and at different times of the year to look for differences.

118. SIMPLE HOMES FOR ANIMALS

You will need to get permission from your principal to do this activity, and it will be helpful to communicate with custodians and other teachers and students about your temporary study site. Allow your students to place stones, logs, pieces of tile and boards on the ground in different areas of the campus. Students should keep a record of how long it takes before animals are found under the "homes" placed in the sun or the shade? Why are the animals shaped the way they are? What do these animals eat?

Diameter in inches	Number of 16' logs	(Cell numbers represent board feet) 1	2	3	4	5	6	7	8
12		62	80	133	183	235	286		
14		64	88	147	210	274	338		
16		67	96	163	242	320	399		
18		71	109	190	280	370	459	550	701
20		75	123	221	330	435	543	651	758
22				258	383	509	633	760	884
24					438	584	728	882	1035
26						666	832	1013	1190
28						750	941	1114	1346
30						850	1062	1291	1518
32							1195	1149	1700
34							1333	1614	1898
36							1494	1782	2095
38								1955	2305
40								2150	2523

How many board feet are in all the trees measured? How many picnic tables could be constructed from the campus trees? (First determine the number of board feet in a picnic table.) Are these trees more valuable left where they are or as lumber? Why?

119. TRACK STORIES

Allow students to discover "track stories" in the sand or mud. Search closely for the trails and tracks of insects, mammals and birds. Students should attempt to draw as many conclusions as possible from the tracks. What made them? What was the animal doing? How many animals were there? Was it moving fast or slow? Attempt to find a track story involving two different animals.

120. RECORDING TRACKS WITH SMOKED PAPER

An interesting way to record the tracks of animal visitors is to prepare several pieces of smoked paper. To make smoked paper hold regular paper, shelf paper, or poster paper over a burning candle. The paper will collect carbon from the smoke and anything that touches the surface will be marked. Put food items suggested by students in a bait station on the ground. Place the smoked sheets encircling bait at several places around the school grounds. Students should make as many deductions as they can about the animals which made their marks. (You will need to do this right before you leave in the afternoon and check the area the first thing the next morning.)

121. RECORDING ANIMAL SOUNDS

If the school has a tape recorder, use it to record singing crickets, grasshoppers or birds. Combine this with a study unit on animal sounds. Stress the purpose and mechanics of animal communications.

122. NATURAL COLORATION AND SURVIVAL

Purchase or color toothpicks in the following pattern: 100 red, 100 green, 100 yellow, 100 blue and leave 100 their natural color. Take your class outdoors to a grassy spot and mark off a 1-square-meter area. Spread the toothpicks evenly throughout the area. Give a pair of students the following instructions: You are a toothpick-eating bird. You have two minutes to capture toothpicks. You can use only one hand; place your other hand in your pocket or behind your back.

Allow four or five pairs of students to try the exercise. Replace the "captured" toothpicks after each trial. Keep a record of the number of each color captured for each trial. Make a bar graph to show the results. Which color was caught the least number of times; the most? Why? Discuss protective coloration. What would happen if a different background such as dry leaves, sand, etc., were used?

As a twist to this activity, place a tight rubber band around the thumb and index fingers of one of the "birds". How does this affect captures? Are some "birds" better adapted for hunting toothpicks than others? An eye patch over one eye can also bring some interesting results.

123. FOOD AND ANIMALS

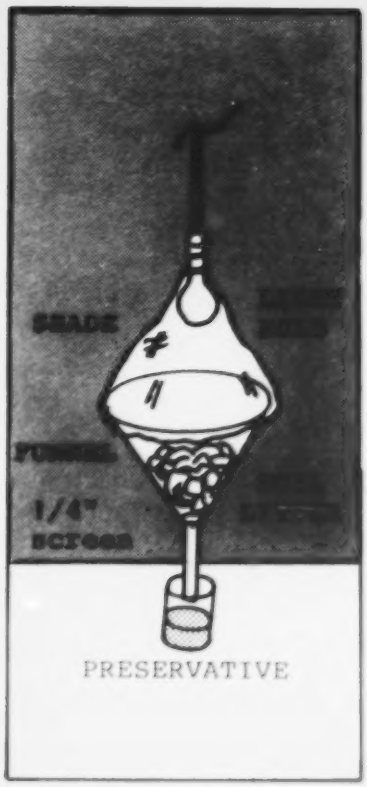
Choose a Brazilian pepper tree (one with fruit), a live oak with available acorns, a grass that has gone to seed, or any plant which seems to contain food for animals. Through an acceptable sampling technique and the use of a balance, calculate the weight of food (seeds, berries, etc.) on a given portion of the tree or plant. (Be certain to measure only food portions, i.e., not the seed at the center of the fruits, the shell of the acorn, or the wing or husk of a seed.) Estimate the amount of food available on the entire tree or plant. Next choose a given wildlife species known to feed upon the food. As best you can, estimate the weight of the animal and its daily food weight requirement. (Example: gray squirrel - weight 16 oz., daily food requirement - 3 oz.; the shrew - weight 2 oz., needs 4 oz.; the mockingbird - weight 4 oz., needs 4 oz.) Problem: For how long a period could the tree or plant support a given species of wildlife? Ten of that species? Fifty? One hundred? Present the problem in worksheet form. How many trees would be required to support X number of that wildlife species?

124. SCAT BOARDS

Many of the animals living on or near the school campus are nocturnal, meaning they only come out at night. Evidence of their presence may be seen by placing baited scat boards in different areas of the campus before leaving in the afternoon and checking it as the first morning activity. A scat board is simply a 6 to 12 inch square of plywood or tile used to collect animal droppings. Place a small amount of a rolled oats and peanut butter mixture on the boards as bait so that the animal will stay long enough to deposit droppings. If the area around the scat board is sandy or dusty, animal tracks can also be found. (See #119 and #120 Tracking.) Unbaited scat boards can also be used. Compare baited to unbaited. Which areas of the campus show the most evidence of animal activity? Examine the droppings for seeds and parts of other animals that may have been eaten. (Be careful not to handle raccoon droppings as they carry bacteria that can affect humans.)

125. DECOMPOSITION OF ANIMALS

Have your students determine the rate of decomposition of dead animal materials by two different types of decomposers. This activity will demonstrate the significance of large and small decomposers in mineral recycling. Build two small cages large enough so that each one can hold a 1000 gram dead animal or piece of meat. One of the cages should be covered with 1/2 inch mesh hardware cloth; the other cage should be covered with 14"x18" mesh screen (window screening). Build a tray covered with loose fiberglass or nylon screening cloth inside each cage. The dead animal or the meat should rest on the tray so that the meat is in contact with the soil. The animal or meat can be weighed each day by attaching a spring balance to the tray. Keep a record of the weight loss or gain in each cage. The larger mesh allows large insects and flies into the cage. In which cage did decomposition occur faster? In which cage did more decomposition occur in the first five days.



126. SOIL ORGANISMS

Have groups of your students construct Berlese funnels (see drawing). Go out on campus and collect top soil and leaf litter from different areas of the campus. Keep a record of the locations of samples. Place a piece of 1/4 inch screen in the funnel; this will prevent soil and leaf litter from falling through. The tin foil shade will direct heat from the light bulb onto the soil. As the soil dries, the insects and other organisms will dig downward and eventually fall into the jar of preservative. Allow the apparatus to stand for 24 hours. Examine the soil animals. Count the number of different types from each area. Why were there differences? What do you think most of these animals eat? How do they help form soil?

127. SPIDER WEBS

Using the chalkboard, draw a generalized spider web using four different colors of chalk to differentiate the four principal parts of the web: (1) cables (which support the web by attachments to nearby objects), (2) roadways (which provide transportation routes for the spider to and from the center of a web and transmit vibrations of struggling insects to the waiting spider), (3) spokes (like the spokes of a wheel, the spokes give support to the web, spacing the threads and providing points of attachment), and (4) sticky threads (which actually catch the insects). Walk around the school grounds and building searching for spider webs. Have students distinguish the four portions of the web.

128. SPIDERS

The class should make detailed notes, step by step, of the actions of a spider in its web. (Examples of actions might be: (1) Spider remains immobile, yet movement of feet seems to indicate an awareness of the trapped prey; (2) Spider begins to advance slowly in the direction of trapped prey, which is continually struggling; etc.) This activity works best if you divide the class into small teams or into pairs for observing several webs. Comparing results, what similarities of behavior existed? What differences were noted?

129. INSECT CENSUS

Compute a census of the population of selected insects on the school grounds. Prepare a grid system of the school grounds and collect data from a random sample: (1) Count numbers of mole cricket runs on ground; (2) Count ant lion funnels in sand, (3) Count ants; (4) Count number of mosquito larvae on water surfaces; etc. In which types of habitat (grassy, sandy, sunny, open, wet, dry, etc.) is each of the animal types most abundant?

130. CAPTURING SPIDER WEBS

Go out on the campus and locate a spider web. Gently remove the spider from the web and take it to another location. Spray the web with white enamel spray paint; use a good quality paint. Cut a piece of black construction paper slightly larger than the web. Spray the paper with a clear drying fixative spray or clear enamel spray until the paper is wet. Gently place the wet paper against the painted web. Next cut the web from the objects to which it was attached. Display the captured webs in the classroom. Make a study of spider webs. Each kind of web indicates a different kind of spider.

131. INSECT DIVERSITY

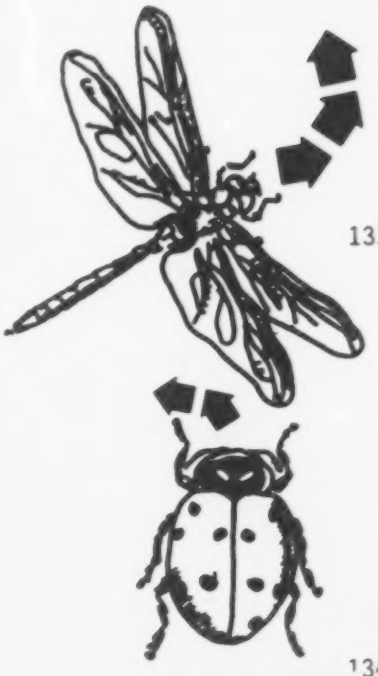
The number of different kinds of insects living in an area can indicate if the area has been recently disturbed or not. Have your students pick two different areas on campus. One of these areas may be in a recovery stage from construction or grass cutting. Use insect nets and take at least ten samples of 250 strokes each in both areas. Place the specimens in killing jars and then sort them. The sorting should be made to the species level, but identification is not important. Simply separate by characteristics. Keep a record of the number of species and the total number of individuals. Place the data into the following formula:

$$\text{Insect Diversity} = \frac{\text{Total number of species}}{\text{Total number of individuals}}$$

Which area had the highest diversity (most different kinds of insects) and why? Try to give reasons for differences in the species diversity, remembering that a larger diversity of insects would probably indicate a greater plant diversity.

132. INSECT BEHAVIOR - KINEKINETIC VERSUS ORTHOKINETIC

Insects under trees are said to typically exhibit one or two forms of behavior: (1) Kinekinetic behavior (which is simply a speed increase); (2) Orthokinetic behavior (which is simply a greater amount of turning). Students should work in pairs with a sheet of paper with two columns for each of the terms, which can easily be simplified. Testing a variety of insects (ants, beetles, crickets, etc.) in the field and placing them under stress by gently touching them with pencils or fingers, students should record on the work sheet the form of behavior (one of both) that was demonstrated by the insect. The class should compare the results and attempt to show predictable patterns of behavior for various insects.



133. INSECT MOVEMENTS

Out on campus and have your students collect several different types of insects. Place each type of insect in a different shoe box. Cover the tops of the boxes with clear plastic, glass, or plastic wrap so that the insects can be seen. Have the class observe the way the animals move. How do they use their legs? Are the legs or body parts adapted to any specific forms of movement? How does the insect's movement help it survive? Replace the insects back into their natural environment when the activity is completed.

134. POPULATION PROBLEMS WITH ANT LIONS

Line a shoebox with aluminum foil or plastic wrap. Fill the box with dry sand. Have your students capture ten ant lions from dry areas around the campus. Place the ant lions in the shoebox environment and allow them to build their cones. Add a few ants as food. After a day or two, add ten more ant lions. Continue adding ant lions. Provide an abundance of food for the ant lions. Keep a data record of the original cone diameters and the changes that take place in cone size as ant lions are added. Discuss the concept of territory and similar effects in human populations. What happens when the food source is diminished? Replace the ant lions in their natural environment when the study is complete (within two weeks).

135. LEAF SCALE INSECTS

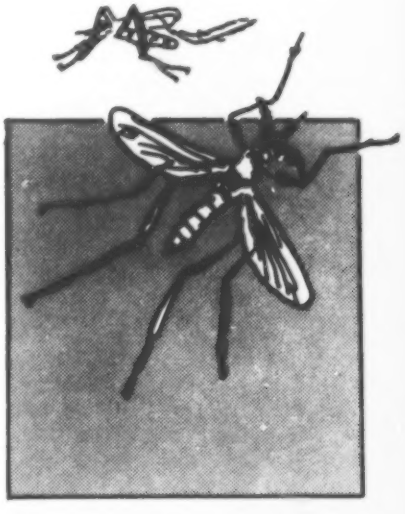
Take your students outdoors and have them examine trees, shrubs, and weeds for signs of insect scales and galls. Students should work with a partner. The groups should estimate the distance from the leaf midrib to each scale gall on the leaf. This distance should be represented by a percent of the distance from midrib to the edge of the leaf. Also keep track of the number of scales or galls. Accurate data records are important. An example of the gall or scale should be kept with each set of data so that different sets of data can be compared. Construct a graph representation of the data. (See drawing.) Discuss the results. In many cases, a bell shaped curve will be found; this shows a random positioning of the scales. In some cases, the graph results will be skewed to the left or the right. This indicates that the insects are positioning the scales in a specific fashion and not in a random way.

136. WHO'S IN THE GALL?

Have your students collect insect galls from plants living on the campus. Place each type of gall in a separate cage. Make a drawing of the gall and the type of plant on which the gall was found. Make drawings of the insects that come from the galls. What type of food do you think each developing insect will need? Return the animals to the habitats from which the galls were taken.

137. MOSQUITO CONTROL

Study the mosquito's life history, breeding habits, and effect on man. Then go out on campus and look for actual and potential breeding sites. How can these areas be changed to prevent mosquito production? If possible, collect a few mosquito larvae and examine them under microscopes. Also, set up two study jars containing larvae. Put oil on the water in one and leave the other alone. What happens? Why?



138. LEAF MINERS

Look for signs of leaf miners, insect larvae that live between the top and bottom layers of leaves. A winding trail will be visible on the leaves of plants where miners have eaten. The trail will be most narrow where the larvae initially hatched and will widen as testimony of the insect's growth until it emerges at the widest point of the trail. Any weedy area should have abundant examples. Ask students to find an example of a leaf miner trail. Trace the trail to show where the insect began and where it emerged. What types of plants do they prefer? What would be the advantage of living inside a leaf? Allow students to draw what they believe the animal looks like. Discuss the advantage and adaptations of this life style.

139. MOLE CRICKETS

Find a moist area on campus and locate mole cricket burrows. Measure the length of several burrows. Determine the average length of the burrows. Dig up one or two mole crickets. How many toes does each animal have? (The number of toes is one of the characteristics used to identify the species.) Examine the feet under a hand lens. How are they adapted for the life style of this insect? Do you think this insect has good eyesight? Develop an experiment that would prove or disprove your hypothesis about the mole cricket's eyesight. On what does the mole cricket feed? Older students may dissect out the intestine, stomach, and crop and examine contents with a hand lens.

140. TEMPERATURE BY THE CRICKETS

Naturalists have discovered that the warmer the temperature, the faster the crickets sing. On cold days crickets chirp much more slowly. Search the school ground and listen for the sounds of crickets beneath boards and stones. Keep some crickets in the classroom for a short time (five days). Using a watch with a second hand, single out one cricket. Count the number of chirps made within 15 seconds. Add the number 38 to the total. The count you obtain will be close to the official temperature.

141. ANTHILL ACTIVITY

Go outside and observe the activity around an anthill. Are ants carrying food? What kind? Do they pay attention to each other? Sometimes when an ant colony is disturbed, the eggs, larvae, and pupae can be seen. Watch nurse ants pick up mouthfuls of tiny white eggs, slender glistening ant grubs, or ant pupae, and carry them to safety. Some ants pupate in a papery cocoon. Others have a naked pupa which looks like a white, inactive ant with all parts formed, including legs. Make a study of ant colonies. How many kinds of ants can you find? Give them descriptive names like mini-reds, two-tones, or pyramid builders. Match the real names of the ants to the descriptive ones.

142. ANT FOOD PREFERENCE

Students should divide into teams, each team choosing a separate ant colony. Place a small portion of several different foods in the vicinity of each colony: (1) cheese, (2) bread, (3) 40 to 50 grains of sugar; (4) chocolate, (5) dead insect, (6) meat, etc. Each team should make the following notes: A. Time it took for ants to locate each type of food; B. Action of the ants once they located food; C. Item which was the favorite food. Teams compare notes in the classroom.

143. TERMITE TRAILS

Discuss with your students ways animals communicate with each other. Some animals use sounds, some coloration, some behavior, and some a combination of things. One communication technique used by many animals is pheromones. Pheromones are chemicals given off by one animal to let other animal of the same species know what is going on around them.

Termites give off pheromones to show each other where they are nesting. The same chemical has been reproduced by humans in cheap, ballpoint ink pens. Collect some termites and have your students work in groups of three or four. Give each group a card, a cheap ballpoint pen, and a live termite. Ask the students to draw a convoluted line on their card with the pen. Then place the termites on the line. The termites should follow the line very well since they think it is a pheromone trail left by another termite.

144. SKETCHING BIRDS

Hand out to the class copies of a generalized drawing of a bird, such as the one shown with this activity (trace if you wish). Approximately four bird outlines to a page work well. Instruct the class to visit the school grounds with paper and pencil, divide up and locate a bird. Students should take note of the coloration and markings of the bird they locate and make notes of such things on one of the bird outlines on their paper. Students should show as many details as they possibly can. Instruct them to take careful note as to the different colors of the bird they observe, and on what part of the bird the different colors end and begin. If possible, choose more than one variety of bird. Return to the classroom and allow students to color one of the outlines according to their notes and observations or to do their own drawings. When handing in their papers, one bird diagram should show evidence of their note-taking. A second diagram should show evidence of the accuracy of their color choice and placement. The diagram provided here can be used by the teacher in conjunction with the exercise to demonstrate the different parts of a bird. Ask students to review the sheet on the topography of a bird and name the parts of a bird which coincide with distinctive patterns or markings on their drawings.

145. PIGEONS AND SPARROWS

Go outside and watch house sparrows and pigeons as they travel over the ground. Let students pretend they are sparrows or pigeons. Devise games based on impersonation and identification. Observe both types of birds in flight. How do sparrows glide? Pigeons? Let the students use their arms to demonstrate flight patterns. Compare the behavior of other common birds.

146. MEASURING FRIGHT DISTANCE OF BIRDS

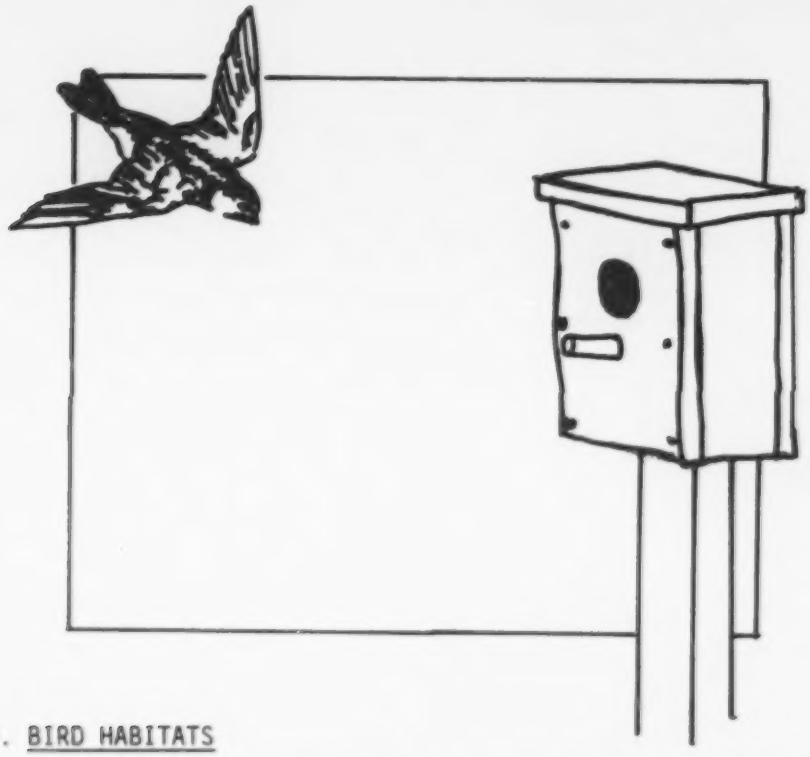
Certain bird species seem to be more timid than others. Various species will allow you to approach only so close and then fly away. This distance is the fright distance. A white cloth with a stone tied in it for weight, a tape measure, pencil, and paper are needed for this activity. Students walk until they sight a bird. They walk slowly toward the bird and drop the cloth when the bird flies away. They then walk to the spot where the bird was and measure the distance to the cloth. Repeat this activity several times for best results. Using the same technique with different species, calculate the average fright distance. Which species of bird in your area allowed you to approach the closest? Which had the greatest fright distance? Make a table listing most-to-least timid kinds. Would shouting affect your fright distance?

147. BIRD MAPS

Make a map of the school grounds and indicate, over several days of observation, the places birds commonly congregate. Correlate this with the need for food, water and shelter.

148. HELP FOR THE BIRDS

Before beginning this activity, obtain permission from the school principal and notify others who might use the campus area chosen for the activity. In early spring, have your students locate a campus area that contains shrubs and trees or an area containing a bird feeder. Set up a platform approximately 2 feet square and 4 feet off the ground. On the platform, place bits of string, small sticks, feathers from a pillow, pieces of yarn and cloth, and any other items that birds might use during nest building. The platform should have a 2 inch raised portion around the edges so that light wind will not blow items away. Keep a record of the number and type of items on the platform. Whenever possible, sit quietly and observe the activity on the platform. Using binoculars will greatly increase the chances of seeing birds. What items were used the most? The least? Did the same type of bird take different things or the same type of things? If a uniform color of yarn is used, you should be able to find traces of the material in bird nests in the vicinity.



149. BIRD HABITATS

Obtain principal permission, then have your students construct several different types of bird houses, feeders, and baths. They can be made from milk cartons and jugs, wood, and/or plastic dishes. Place these in different areas of the campus near cover plants. The students should organize maintenance teams to keep the feeders and baths filled and cleaned. Allow students to observe birds. Keep a species list. What foods bring the most birds? What birds are nesting in the bird houses? Bulletin boards with pictures of the birds frequenting the area can be made. Reports on the life habitats and natural history of each bird can be given. Have a member of the local Audubon Society come to your class and talk about birds of the area.

150. BIRDSEED FARM

Before beginning this activity, obtain permission from the school principal. Have your students plant sunflowers, milo, and millet on an area of the campus. Build a bird feeder and place it in a protected area of the campus. When the sunflower, milo, and millet are mature, have the students harvest the seeds and place them in the feeder.

151. DEMONSTRATING SIZE TO STUDENTS

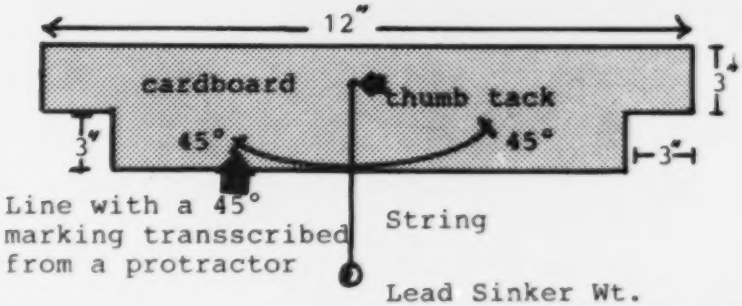
Most students have trouble with the concept of size simply because they have never really seen objects that are often used to make size comparisons. Take your students outdoors to a flat area of campus. Have your class outline some specific objects. Use straightened coat hangers with different colored file cards taped to them to outline the objects under study. Delineate such things as an acre of land, a whale, a giant Sequoia, a dinosaur, the Statue of Liberty, a 747 airplane, a Piper Cub airplane, the "Mayflower", a modern aircraft carrier, etc. Allow the students to obtain the necessary measurements from the library or from other sources.

152. MEASURING WITH SHADOWS

Older students can measure many large objects with shadows, since the size of a shadow is directly proportional to the size of the object. Thus, if a 12 inch ruler held perpendicular to the ground throws an 8 inch shadow, and a tree shadow is 18 feet, 6 inches (222 inches) long, the tree will be 27 3/4 feet tall (8:12 :: 222:x). Calculate the height of trees or the flagpole on campus.

153. HEIGHT OF OBJECTS - THE MUDDY WATER METHOD

To estimate the height of trees, poles, and buildings, have your students mix up some mud and water in a large basin or dissecting tray. Place the container of the muddy water on the ground between the student and the object to be measured. Step away from the container a distance equal to that from your eyes to the ground. The top of the tree, pole, or building should be seen as a reflection in the muddy water. If not, move the basin one way or the other until the reflection is seen. The distance from the container to the foot of the object is equal to the height of the object. A mirror can be used instead of the muddy water if it is available.



Clinometer Construction Details

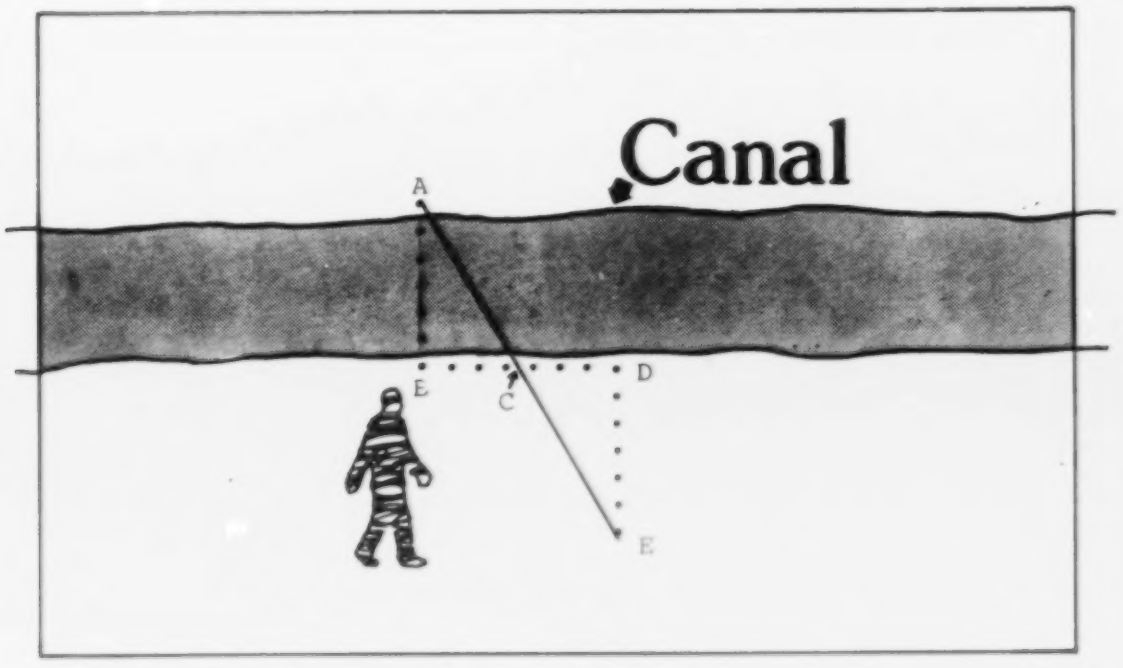
154. USING THE CLINOMETER TO MEASURE HEIGHT

Have your students construct simple clinometers and use them to help determine height of trees and buildings. Use sturdy cardboard, a thumb tack, short piece of string, and a small weight in the construction. (See drawing.) A protractor is also needed to help designate lines of degree on the clinometer.

To use the clinometer, back away from the object to be measured until an imaginary line from your eye to the top of the object forms a 45 degree angle to a horizontal line from your eye to the object. Sight along the top of the clinometer until the weighted string is resting on the 45 degree line. The lines of sight along the horizontal and 45 degree angle form two sides of a right isosceles triangle. The 45 degree line is the hypotenuse, thus the distance from the object to the person along the horizontal line is equal to the height of the object.

155. MEASURING YOUR PACE

Ancient men measured distances by pacing and by using the width of a hand. Have each student, with the help of a partner, measure his/her own pace (a normal step measured from the toe of the rear foot to the toe of the front foot). Students should write down the measurement of their pace to the nearest 1/2 inch. The teacher should measure and mark off a distance of 100 feet on the school grounds. Students should walk the distance twice -- count the number of paces each time and compute their average number of steps. Now divide the 100 feet distance by the average number of steps taken. The answer will be their pace. Compare this to their original measurements. Now have each student measure (by pacing) the distance from outside the classroom to the the office and back; to the gym and back; to the flagpole and back; the bus stop and back, etc. Students compute each distance to inches. Write class results on board for each distance measured.



156. MEASURING DISTANCE ACROSS A CANAL OR ROAD

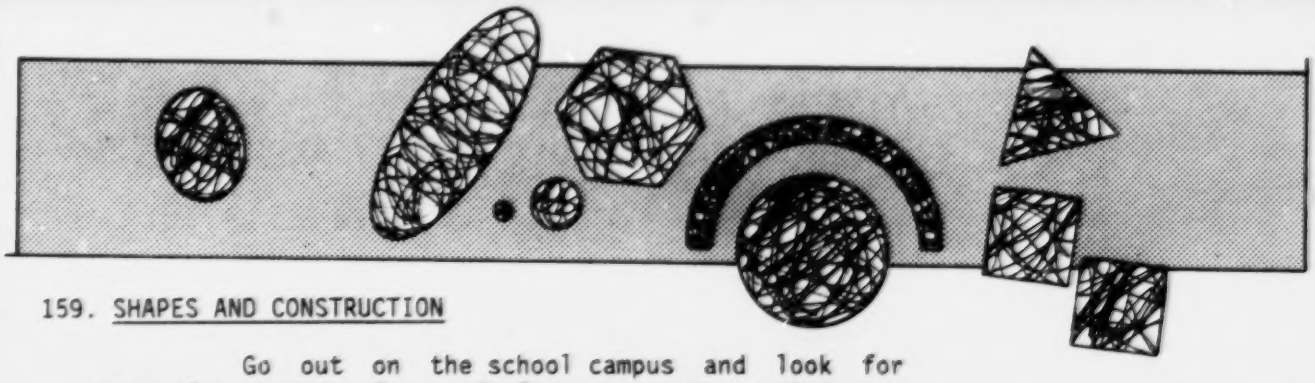
Leading students to a canal, blacktop court, etc., on campus, demonstrate a technique that could be used to measure distance across a river, gorge, etc. Select a mark, (A), on the opposite side of the canal or blacktop. This might be a tree, a distinctive bush, or a stake previously placed there. Place a stick, (B), in the ground on your side. Walk at right angles to the canal for a known number of paces and put in another stake, (C). Continue in the same direction for the same number of paces and place another stake, (D). Now turn at a right angle away from the canal and proceed in a straight line until stake (C) is in line with marker (A). At this point place another stake, (E). (See drawing.) The distance from stake (D) to stake (E) will equal the distance across the canal. (BC = CD and DE = AB.)

157. ESTIMATING DISTANCE

This activity can be done by small groups or by individual students. Take your class outdoors to a relatively flat area - a P.E. field works well. Place a stake in the ground and stretch a piece of string 200 feet from the stake. Fasten the other end of the string to another stake. Be accurate in this measurement. If possible, use a 100 foot measuring tape to determine the distance. Give each group of students three straightened coat hangers and three file cards. The cards should be colored white, red, and blue. The students should put their names on all three flags so that they can be identified during the exercise. Tape the cards to the coat hangers to form flags. Using the white flag, students should guess where the 100 foot point would be along the string. In order to do this, the class should move away from the string and then make a guess. Place the white flag at the guess point. After the guesses have been made, have the students estimate where the 100 foot point would be by using the pacing method. Place the blue flag at this point. Finally, give each group a yardstick or ruler to actually measure the 100 foot distance. Which method worked best for the majority? Why were there differences even when the yardsticks and rulers were used? What was the range (lowest to highest) in guesses; the estimates; the actual measurements? Where was the smallest range found? Why? Determine which measurement occurred the most number of times.

158. ESTIMATING

A simple exercise dealing with estimating techniques can be conducted by asking students to go find a hundred of something and prove it. (For example, a hundred leaves on a tree.) Emphasize that you want them to find a way to estimate without actually counting each item. Count the number of branches on the tree. Frequently chosen items are grain of sand, plants of moss, weeds, bricks on a building, etc.



159. SHAPES AND CONSTRUCTION

Go out on the school campus and look for triangles, rectangles, circles, arcs, etc., that are found in the buildings and playground equipment. Why was each of these shapes used in a particular piece of construction? What is the advantage of using a triangle instead of a rectangle or square? Look for things that use the principles of "compression load". (An example of this would be the fact that a length of board can support more weight when it is placed on end with the weight on top than if the board is put in a horizontal position with the weight in the middle.)

160. POLLUTION MATH

Instruct the class to bring paper and pencils and sit in a group outside, under a tree. The following exercises are a good outdoor "warm-up" and can be used to precede any of the math exercises in this book.

1. One American is responsible for one ton of garbage per year. How many pounds is this per day? How many pounds per day for the class? What happens to this trash?

2. Air pollution costs the average American $150.00 per year. How much is this for the entire United States?

161. BIRD FEEDER ARITHMETIC

Set a bird feeder up on the school campus. Once the feeder is established and birds are frequenting the area, take your class outdoors to the area. The concept of sets can be demonstrated around the bird feeder: birds on the ground, birds on the feeder, birds flying. There are also sets of sizes, color, and kind. Younger students may enjoy showing bird arithmetic problems by using felt cut-outs and a flannel board. Older students may use math to determine the amount of seed eaten in one day, one week, and one year, the cost of seed, etc.

162. MATH WITH ANTS

Students divide into pairs, each pair with a 12 inch ruler, pencil, and paper. Each group locates an ant and determines how many inches the ant will travel in one minute (use a watch or count "one-thousand-one, one-thousand-two", etc.). Then calculate an average ant speed from several examples. How far would the ant go in one hour? How many miles an hour does that mean? How long would it take an ant to go non-stop to Miami? What was the fastest ant recorded that day? Compare an ant and a human at the 100 yard dash. Compare the sizes of ants and humans; which runs faster for its size? Important: Students do not touch the ants to do this activity.

163. MATH WITH SANDSPURS

How many spines does a sandspur have? A simple math exercise allows students to compute the average number of sandspur spines on a given sandspur. Students collect a representative sample of "spurs", count, and compute the average number of spines. For additional alternatives, compute the average number of "spurs", not spines, for the plant. Using sampling techniques, compute the total number of plants for the school grounds. How many spines would this be? A variation of this can be conducted with the average number of seeds per grass or weed.

164. WRITING IN THE OUT-OF-DOORS

Aesthetic writing experiences in the outdoors can best be accomplished by asking each student to find his/her own tree and sit down quietly against it with the necessary writing materials. This technique will adequately space students and discourage conversations and group interaction at a time when you want to encourage personal creativity. Try to establish the desired atmosphere by also sitting against a tree as the students begin their writing. The class may be called together, allowing students to sit in a circle to share some of the writings. Students can disperse to their individual trees for a new assignment.

165. HAIKU POETRY

Haiku poetry was originated by the Japanese. The emphasis is on syllables, not rhyme. It consists of three lines. The first line has five syllables, the second has seven, and the third line has five. The art of haiku is to capture in words the "quick reaction" one gets when observing something that dramatically catches the eye. In subject areas such as science and social studies, Haiku poetry can be used to stimulate discussion of such things as animal and plant life, food webs, pollution, human relationships, building codes, transportation problems, etc. Below are two examples of haiku:

Bitter blue berry
As blue as the sky above
Feeds the hungry birds.

Dark moving shadow
Passing over the ground
It is only me.

166. CINQUAIN POETRY

Cinquain poetry emphasizes syllabic form and is similar to haiku. Cinquain has five lines. Each line has a specific number of syllables and purpose: line one is a title containing two syllables; line two is a description of the title in four syllables; line three tells of action in six syllables; line four gives a feeling in eight syllables; and line five uses another word picture for the title in two syllables. In subject areas such as science and social studies, use this form of poetry to start discussions on specific topics. Below is an example of cinquain:

Sandspur
Rounded pointed
Sticks tightly to the flesh
You miserable curse of beast
Painful

167. IF I WERE A....

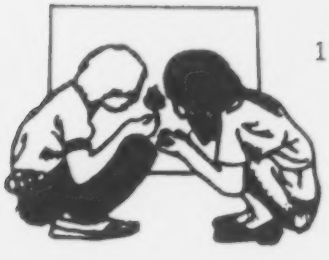
Take your class outdoors and have the students select something from nature as a subject for writing - such as a leaf, a piece of bark, a blade of grass, an ant, a worm, a tree, a bush, etc. Give this stipulation to the students: they must start their paragraphs with, "It is awful being a _____", or "It is wonderful being a _____". Give this example to get the students started: "It is awful being a bush in the parking lot, because the exhaust fumes from the cars wither my leaves." Have the students write at least one paragraph and share the writings with a partner.

168. WHAT WAS EARTH LIKE?

Take your class outdoors and give them the following assignment. Tell the class that they are from a planet in another solar system. "You have just landed your spaceship on this planet called Earth and are now looking around this new environment. Your commander is asking you to report what you see. Remember that your commander has never seen such things as trees, grass, people, sidewalks, cars, buildings, etc. Create a story telling what you see, hear and feel." For younger students the story can be developed through oral means, while older students can write their impressions.

169. CREATIVE WRITING: THE FUTURE - THE PAST

Have your students find a pleasing spot on campus and sit there. Give the students the following situation: "The year is 2001 and there are over one million people living in the Fort Myers area." Have the students write about what the area in which they are sitting will be like in 2001. Then have the class members pretend they are grown-up, and it is the year 2001. Now they should write about what the area looked like when they were children. Discuss the stories and ask how some of the harmful things could be avoided.



170. MINIATURE WORLD

Each student chooses a 4 to 6 inch portion of lawn. Lying on the ground with eyes close to the soil or with a hand lens, ask the students to imagine a travel adventure in their 4 to 6 inches, pretending to be so tiny (ant size) that grass is comparable to a high, dense, and mysterious forest. Students should describe their observations, obstacles, or encounters as if they were visitors to another planet. (Tip: Students can use the tip of a pencil or toothpick to keep track of their position as they travel the distance.)

_____ are becoming more and more common in and near Florida cities as their _____ habitat is taken over by developers.

City dwellers should remember not to approach a _____ that appears _____ or overly _____. It could be _____.

After about _____ months, the young _____ are capable of traveling on their own. They follow their mother until they are about _____ months old. Then they go off on their own.

_____ are omnivorous, meaning they eat both plants and animals. Some of their main foods are _____, _____, _____, and _____. Their keen sense of smell often lures them to _____ where they feast on _____.

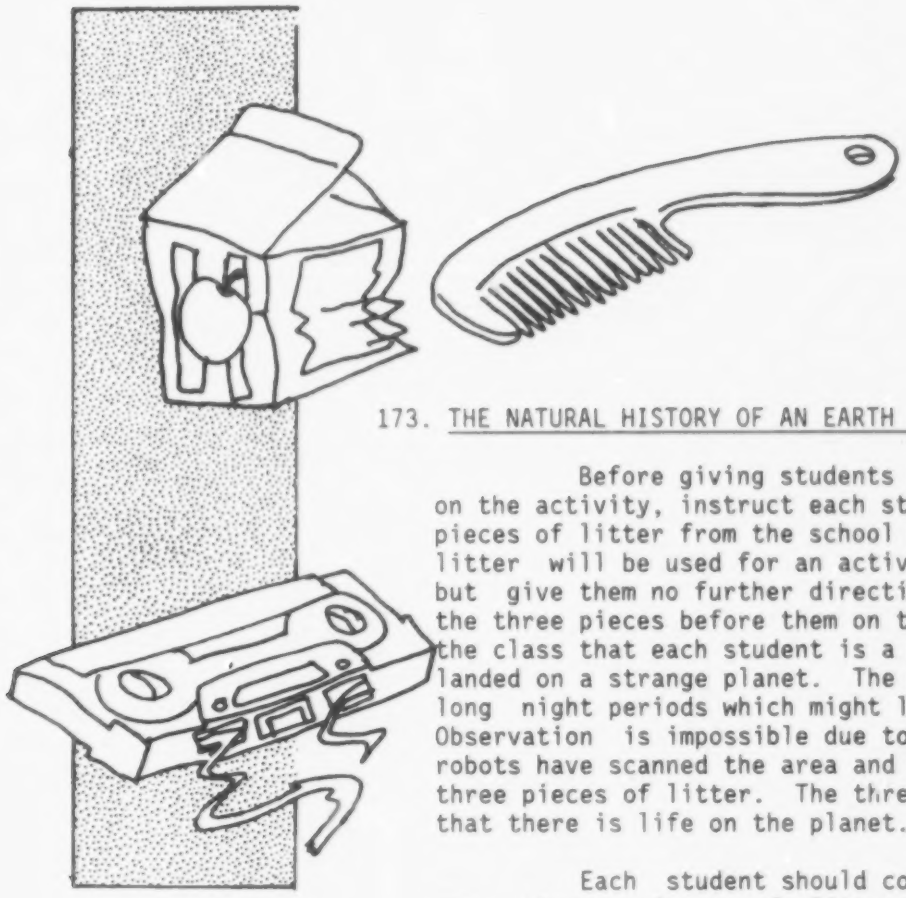
The name "_____" comes from the Algonkin Indian word "_____", which means "_____".

171. STORIES WITH MISSING WORDS

Write a short nature story with some adjectives and nouns missing. Give a copy of the story to each student, and the following instructions: "Go out on campus and find objects or descriptive words about objects on campus that will complete this story. Fill in the blanks with the words and place the location and name of the object in parentheses in the blank." After the students have filled in the blanks, go over the stories and discuss the adjectives and nouns that were used. Emphasize experience as one of the main ways to build vocabulary.

172. "ADD-A-LINE" STORIES

Take your class outdoors and have them create a story by allowing one person to begin telling the story. The first person gets no more than three sentences, then the next person must add to the story. Each successive student can add up to three sentences. The story should take place on the school grounds. If possible, make a tape recording of the story and play it back later in the year. Allow the students' imaginations to flow freely.



173. THE NATURAL HISTORY OF AN EARTH SPECIES

Before giving students any further information on the activity, instruct each student to collect three pieces of litter from the school grounds. Tell them the litter will be used for an activity in the classroom, but give them no further direction. Have them spread the three pieces before them on their desks. Now inform the class that each student is a space scientist who has landed on a strange planet. The planet is in one of its long night periods which might last many earth weeks. Observation is impossible due to darkness. The ship's robots have scanned the area and returned with only the three pieces of litter. The three items have indicated that there is life on the planet.

Each student should concern himself with his own three pieces of litter. Assuming no more information than the litter provides, draw conclusions about the size of the species, the appearance, eating habits, living arrangements, level of intelligence, and sensory apparatus (eyes, with rods or cones dominate?) Color in litter indicates cones and, therefore, activity which occurs principally during daylight. Finding a soda can might indicate many things, even the types of metals on the planet. For what would the contents of the can be used? Is all the material from the same species or from many species?

Remind students that, based on the three pieces of litter, it would be correct to form deductions that, although logical, they know to be false. Once each "space scientist" has made deductions, based on the three pieces of litter, the assumptions or deductions can be formally presented (as a seminar) to the class, who would represent a gathering of leading scientists back on Earth. The class (scientists) should critically challenge the deductions, and the speaker should be prepared to support them. The use of a podium and microphone will aid in formalizing presentations.

174. A DAY IN THE LIFE OF TIMMY TREE

Allow your class members to go outside and observe a living thing of their choice. Take about ten minutes for the observations. Students should write a short story in which they put themselves in place of this living thing. They should include such things as likes, dislikes, friends, enemies, needs, wants, etc. Tell the students to let their imaginations run wild. A drawing can be made of how they would picture themselves as this living thing. A class booklet can be made by compiling all of the stories. How are the different living things interrelated? Are any dependent on others?

175. BECOMING A TREE

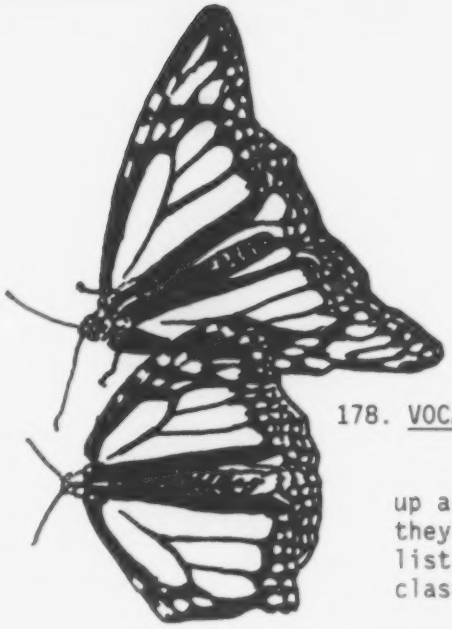
Have students take paper and a pencil outdoors. Tell them to find a tree on the campus. Each student should write a short poem or essay with the theme, "How I Would Feel If I Were This Tree"

176. USING NATURE FOR READING READINESS

Take your class outdoors and ask the students to look for shapes and textures. Look for objects that are rough, oval, triangular, square, shiny, dull, jagged, smooth, fuzzy, etc. The words can be written on 3" x 5" file cards for older students. Give each student a card and have him/her find an object to satisfy or match the word on the card. Both activities will help students to become more selective and accurate in their observation skills.

177. ALPHABET PICTURES

Give each of your students a sheet of paper with an alphabet letter printed near the top of the page. Go outside and have the students draw a picture of something they see that has the initial sound of the letter on their paper. A pictorial alphabet bulletin board using the students drawings can be constructed in the classroom. This same activity can be used to help students remember vowels by having them locate objects with specific vowel sounds in their names.



178. VOCABULARY BUILDER

Take your students outdoors and have them make up a vocabulary list of all the sounds they hear, odors they smell, colors they see, moving things, etc. This list can also be used as a spelling exercise or a classifying activity.

179. OUTDOOR FIGURES OF SPEECH

Have your students go outdoors and write short paragraphs describing things they see. They should use alliteration, metaphor, simile, hyperbole, and onomatopoeia for their descriptions. Compile these descriptions in a class notebook.

180. OPERATIONAL AND NON-OPERATIONAL DEFINITIONS

An operational definition tells how to measure something or how you can tell if you have a certain amount of something. A non-operational definition tells what something is or of what it is made. Have your students go out on campus and write three operational and three non-operational definitions. Each student should be allowed to read a few of the definitions, and the rest of the class should decide in which category the definitions fit.

181. COMPARISONS

Have your students find plants or other objects on campus that show comparisons. Either call out the comparison you want the students to find or give each student a card with the comparison on it. Some examples that might be used: green - greener; tall - taller; dark - darker; small - smaller; old - older; rough - rougher.

182. NATURE SMILES

Have students take a pencil and paper and go outside to an area on campus where they can observe grass, weeds, trees, or shrubs. Ask the students to concentrate on one specific living thing, such as a blade of grass or a leaf on a tree. The students should use at least two of their five senses during the observation time. While observing, students should jot down feelings that result from the activity. By using these written "feelings", students should construct short similes (a figure of speech in which two unlike things are compared explicitly, usually by using the words "as" or "like". (Example: The water was as still as glass.) Students should share their similes with the class.

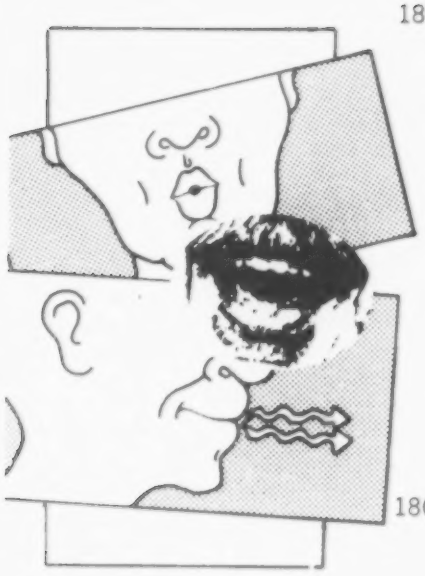
HyperFlora

183. DESCRIPTIVE WORDS

Take your students outdoors and find a tree, flower, or other natural object. Have each student in your class give one descriptive word about the object that would either describe the entire object or part of the object. Allow students to make up words, but they must be able to explain their words to the satisfaction of the entire class. Points can be given for each word given. Allow the student with the most points to pick the next object to be described.

184. DESCRIPTIVE DESCRIPTIONS

Take your students outside and have them find a tree, grass, weed, or any other object of their choice to describe. Students should close their eyes and describe what they feel when they touch the object. Record the observations. Discuss the use of descriptive adjectives and adverbs. Read the descriptive words to the class and have the other students guess what is being described.



185. SPEECH THERAPY ACTIVITY

Special education students, speech therapy, and language arts classes should be taken outside. Students should pick several different natural objects that contain the particular speech sound with which they are having problems. For example, a student working on the "r" sound might pick flowers, trees, and rocks. Each student should then make up a sentence that contains the objects they found. Back in the classroom, have students tell or write a short story or poem using the natural objects as a theme. Another technique that can be used is to have each student contribute one sentence to a class story.

186. NATURE SHORTHAND

Have students learning notehand and/or shorthand go out on campus and write paragraphs concerning what the campus needs in the form of environmental improvements. Then have the class transcribe the paragraphs by using typewriters. The notes can then be sent to the principal or student government as a suggestion for action that might be taken.

187. ENVIRONMENTAL MESSAGES

Have your class prepare a series of short messages concerning the campus and school environment. Read these over the school public address system or present them during school news TV programs. Try to include action and solutions to problems in the messages.

188. WORD MAPS

Divide your class into small groups. Each group is to describe a map route or trail to some place on campus. No drawings can be used. Exchange word maps and let each group try to follow the word trails. This activity can be varied by allowing only five words for each direction given, or by stipulating that direction of movement must be changed six times, but only five word directions can be given. Discuss the value of using the right words, and giving precise and concise descriptions.

189. CAMPUS NATURE BOOK

Give each student a piece of drawing paper and pencil or crayons. Have students make drawings of one natural thing on campus that they like. It might be a tree, grass, birds, bugs, sky, clouds, etc. Students should write a short paragraph about their drawings or make up a short poem about the drawing. Compile these drawings into a class book with the title, "Campus Nature Book". This can be placed in the library or in a prominent place in the classroom.

190. NATURE PLAYS

Have students divide into groups of five or six. Each group should go out on the school grounds to observe the living things that can be found at your school. Tell students to look on the ground as well as in the trees and shrubs. Each group should write/create a short play using the things they saw as characters. During another class, have the groups present their plays.

191. PUPPET SHOW

Have your class make puppets that could be used to play out an environmental mystery. Some students can write the play while others work on the puppets. Present the play to other classes or schools. Use your campus as a basis for the story and use natural objects from the campus for the backdrops and puppets.

192. CAMPUS ENVIRONMENTAL NEWS

Send student reporters out to different areas of the campus to look for environmental problems; they can run on-the-spot surveys, etc. Have the class produce a quarterly newspaper that concerns itself with campus problems. Environmental poetry and short stories could be included.

193. SEASONS

Divide your class into four groups. Have each group make a poster collage of campus items that could depict one of the seasons. Students will have to collect small articles from the campus. This activity can lead into a discussion of the scientific causes of the seasons.

194. SEASONS WITH A CAMERA

If deciduous trees are available to you on your school campus (cypress, red maples, etc.), an excellent project is to make a photographic record of the tree throughout the seasons as its leaves develop, reach maturity, and eventually fall. Utilize the same stake or fencepost for your camera to ensure the identical angle each time a photograph is taken.

195. TEMPERATURE TAG

Divide the class into small groups. Give each group a thermometer and piece of paper with a temperature printed on the top. The students should go outside and find an area that has the same temperature as that on their papers. They should then write a short description of the area. Why were the temperatures different in different areas? Use the written descriptions to help explain differences.

196. RECORDING TEMPERATURES

Let students stand in the bright sunlight so that their shadows are behind them, holding a thermometer in the light until the fluid stops moving. Record the temperature. Then have them turn in the opposite direction and hold the thermometer in the same position in their shadow. Wait for a change in temperature reading. Record the temperature. Discuss with the students the fact that objects which block the sun shutoff heat waves as well as light waves.

197. WIND ON THE CAMPUS

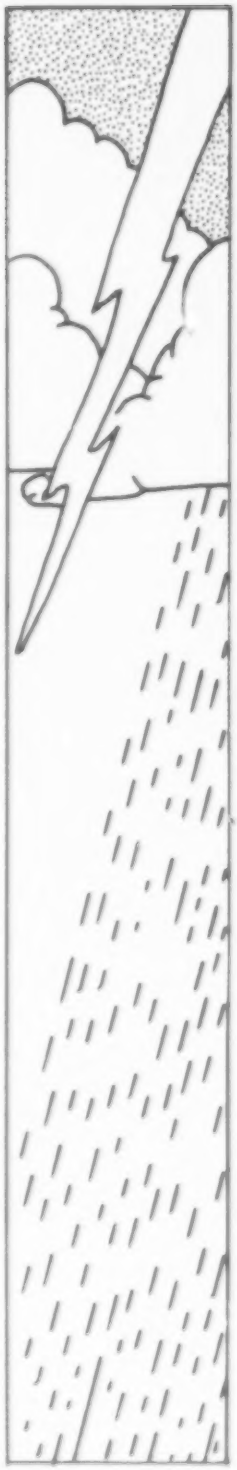
Discuss with your students the origin of wind. What types of things create wind. Then, take the class outdoors to determine the wind directions and wind effects on the school campus. Send students to areas throughout the campus. Try to include all parts of the campus - corners of buildings, breezeways, trees and shrubs, parking lots, etc. Use pieces of light yarn or ribbon to determine wind directions. Draw a map of the school grounds on the chalkboard and indicate wind directions with arrows. Ask students to look for indicators that show which way the wind blows (piles of sand, litter in one area, trees bent in one direction, etc.). Could the school campus be designed to take advantage of wind directions? If so, how?

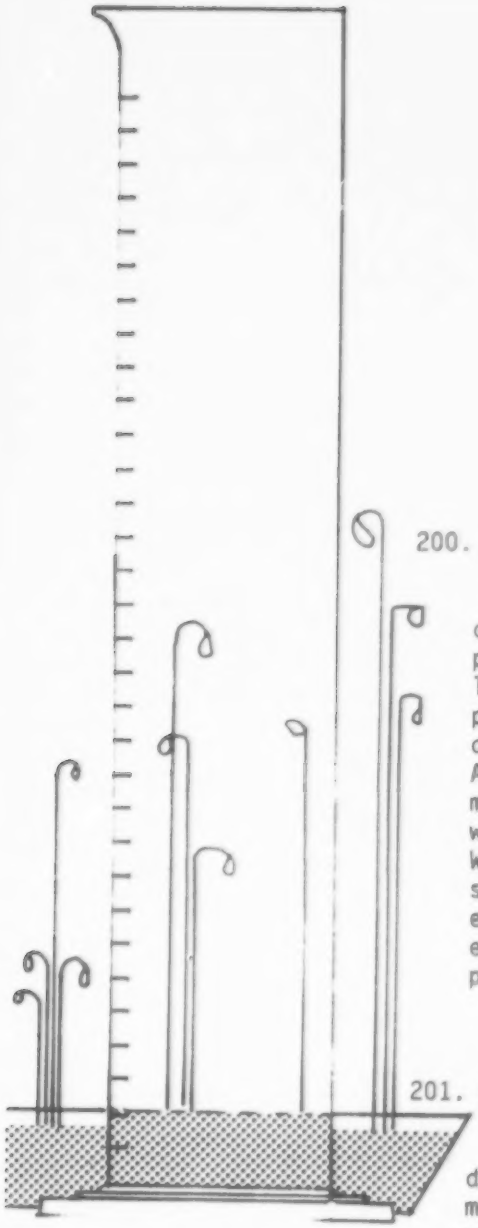
198. OVERCAST OBSERVATIONS

Take your students outside on an overcast day to make observations of the environment and to record temperatures. If available, give small groups thermometers to determine the temperatures from all over the campus. Record the temperature readings taken near trees, buildings, open grass areas, and roadways. Look for such things as shadows and the relative amount of light penetrating beneath trees and shrubs. What do the clouds indicate? Now take your class out on a bright, sunny day and repeat the same observations. Discuss the differences and similarities between the two sets of observations.

199. LIGHTNING ESTIMATES

This activity will help students learn how to estimate the distance between them and lightning. The lightning flash and the sound of thunder are produced at the same time. Light travels at 186,000 miles per second; thus, the flash reaches our eyes almost instantly. The sound of the thunder travels at a speed of approximately 1,110 feet per second. By counting the number of seconds between the flash and the sound of the thunder, the distance from the person to the lightning strike can be calculated.





200. EVAPORATION RATES

Have students measure, with a graduated cylinder, equal amounts of water into several shallow pans. Have students place the pans in several different locations around the campus. Place one of the water pans under a shrub or tree, one in an open grassy area, one among some weeds, one in the parking lot, etc. Allow the pans to sit for one to four hours. Then measure the water again. Record measurements. Why did water evaporate faster in some areas than in others? Was the wind the same at each spot? Was the amount of sunlight the same? What was the water temperature in each pan before and after the experiment? Discuss evaporation rates and the differences they make when planting or designing a landscape.

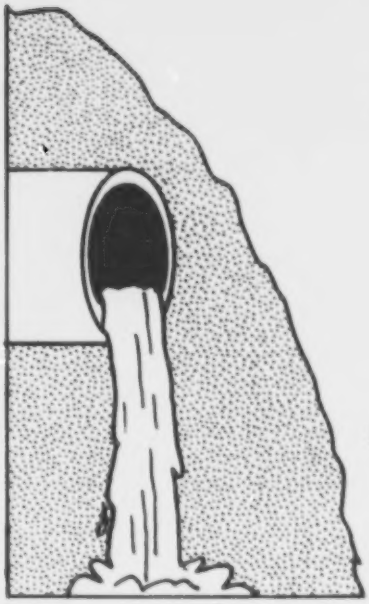
201. MEASURING EVAPORATION IN MINI-CLIMATES

The purpose of this study is to compare the different rates of evaporation (a product of air moisture) in different mini-climates. This, in turn, will help demonstrate the differences that exist in micro-communities. Wet several paper towels and squeeze them so they are just damp. Open up the paper towels and place each in a separate mini-climate around the school grounds (e.g. spread out, tacked on yardsticks above the ground in a sunny site, on yardsticks in the shade, on the top of shrubbery, on the ground, under a board). Record the time each towel was put in its place and the time when the towels were completely dry. Ask the students to give reasons to account for the different drying times. What conclusions can be drawn about the animals living in each of these areas?

202. RELATIVE HUMIDITY

Have your students construct hygrometers and determine the relative humidity. A hygrometer shows how much water or moisture is presently in the air as compared to the amount that the air could hold, if saturated. Relative humidity is represented as a percentage. Warm air can hold more moisture than cool air; thus, on a night after a hot, muggy day, rain can be expected if the weather becomes cool that night. To construct a hygrometer, wrap a piece of cloth around the bulb of a thermometer and place the loose end of the cloth in a dish of water. The thermometer is then suspended about an inch above the water, but not so far that the loose end of the cloth comes out of the water. This thermometer is called the wet bulb. Another thermometer is placed by the wet bulb, and is called the dry bulb since it does not have the wet cloth attached to it. Record the wet and dry bulb readings. Subtract the wet bulb reading from the dry bulb reading in the horizontal row where the number for the difference between wet and dry bulb readings was found. Follow the dry bulb reading column toward to find the percent of relative humidity.

No. of degrees difference between Wet and Dry Bulb Readings	Dry Bulb Readings in Degrees Fahrenheit							
1	90	92	93	94	95	96	96	97
2	79	84	87	89	90	92	92	93
3	68	76	80	84	86	87	88	90
4	58	68	74	78	81	83	85	86
6	38	52	61	68	72	75	78	80
8	18	37	49	58	64	68	71	74
10		22	37	48	55	61	65	68
12		8	26	39	48	54	59	62
14			16	30	40	47	53	57
16			5	21	33	41	47	51
18				13	26	35	41	47
20				5	19	29	36	42
22					12	23	32	37
24					6	18	26	33
Relative Humidity in Percent	30%	40%	50%	60%	70%	80%	90%	100%

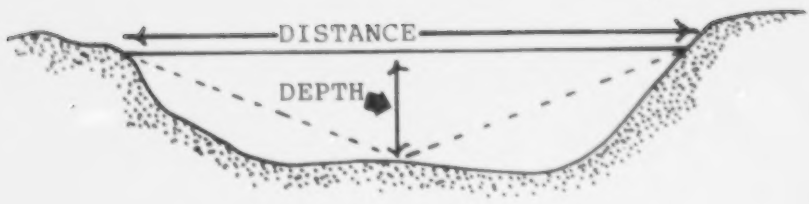


203. STORM RUNOFF

Have your students determine the amount of storm runoff from paved and surface areas on your campus. Determine the amount of ground area that is covered by buildings, parking lots, sidewalks, streets, athletic tracks, etc. Have a group of students call the local weather bureau and find out how much rain fell during the preceding year. Ask the weather man what area one inch of rain covers. The weather man should have conversion figures for inches of rain to gallons of water. From this information your students should be able to determine the amount of water runoff. Where did all this water go? What happened to the water before the surfacing and paving? How many trees might need to be added to the campus to prevent excessive runoff?

204. WHAT HAPPENS TO THE RAIN?

During the rainy season, have your students determine how much water falls on different areas of the campus and where that water drains. Make graduated cylinders from orange juice cans. Allow your class to decide where the rain gauges (juice cans) should be placed. Be certain that such areas as open lawns, the ground under trees and shrubs, the ground near buildings, and parking lot spaces are included. Have your students locate drainage ditches, sites that show signs of erosion, areas where the soil is compacted, and areas where water stands. Are there areas that receive more water than other areas? Is the vegetation different in these areas? What effect does standing water have on soil organisms and on insect populations such as mosquitoes? Is improper drainage harming soil, buildings, or sidewalks? Where does water falling on the buildings, parking lots, streets, tennis courts, etc., go?

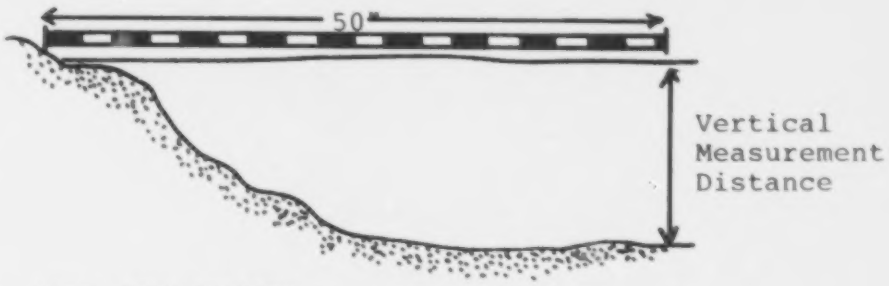


205. HOW MUCH WATER IS MOVING IN THE CANAL?

Have your class calculate the rate of flow in a canal or stream. Stream flow is the amount of water passing a fixed point during a specific amount of time. The formula for calculating flow is Q = AV (Q = discharge in cubic feet per second; A = cross section area of channel at sampling site; V = velocity at sampling site). To obtain "A", determine the depth at the middle of the canal and the distance across the canal. Next, connect the ends of the distance line with the bottom of the depth line to form a triangle. Use the formula, Area = 1/2 bh to obtain the area of this triangle. To obtain "V" or velocity, place an object in the center of the canal and time its movement for ten seconds. Repeat the timing procedure and obtain an average (be certain that the wind is not moving the object). Place the data for "A" and "V" in the formula and calculate "Q". By using the value for "Q" and information gained on the amount of such chemicals as nitrates and phosphates, the amounts of these materials passing from the canal into lakes, streams, and bays can then be discovered.

206. EROSION CONTROL

Have your students make a survey of the school campus for signs of erosion. A school campus map should be used, and the areas showing signs of erosion should be marked. Indicate the type of soil in the area and vegetation types. The erosion should be classified according to what caused it - wind, water, cars, people, etc. Remedies should be formulated and a plan of action devised. If possible, students should be allowed to help make the campus improvements recommended in their plan of action. For younger students, find an area on campus that has an incline. Pour water on the soil to show the effects of water erosion. Locate an area that has grass, and repeat the exercise. Ask the students how they could remedy a situation in which erosion is occurring.



207. CANAL BANK EROSION

Select a canal bank near the school grounds and determine the change in slope and rate of the change. Divide the class into small groups and give each group a stick that is 50 inches long, a level, and then measure the vertical distance from the free end of the stick to the slope. Place the data into the following formula to determine the percent of slope:

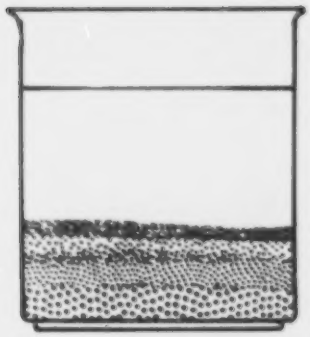
Vertical Distance X 2 = % slope

By repeating this activity at weekly intervals throughout the year, changes can be determined. Graph the results. Measure different areas of the canal bank and compare changes (bare areas compared to grass areas).

208. SOIL COMPACTNESS

Have groups of students build simple soil compactness testers and then determine the degree of soil compactness in various place on the campus. A pencil or sharpened dowel, a large spool, and a heavy rubber band will be needed to construct the soil tester. Mark the pencil every 1/8 inch so that it can be used to measure force.

The pointed end of the apparatus should be placed on the soil to be tested. By pushing down on the spool, the pointed stick will penetrate the soil. The student should record the number of marks the spool moves. A map can be made showing the areas tested. Notes should be kept about each test site. Such things as type of vegetation, exposure to sun or shade, rocky, sandy, or mixed soil should be recorded. Try to discover why some soils are more compact than others. Do people walk on the soils tested? Is the soil around an anthill as compact as that in the anthill? What roles do ants, worms, and other insects play concerning soil compactness?



209. SOIL PARTICLE SIZE

Divide your class into small groups. Give each group a quart jar approximately three-fourths full of water. Assign each group a different area of the campus to sample for soil particle size. Students should collect four tablespoons of soil from their sampling sites. Place the soil in the jar of water and shake vigorously and then allow the particles to settle. It may take overnight to get complete settling (1/4 teaspoon of alum and a teaspoon of household ammonia will speed up the process). Measure each layer and calculate the percent each layer is of the whole. Compare soils from different areas of the campus. Why do some areas differ?

210. SOIL AND WATER MOVEMENT

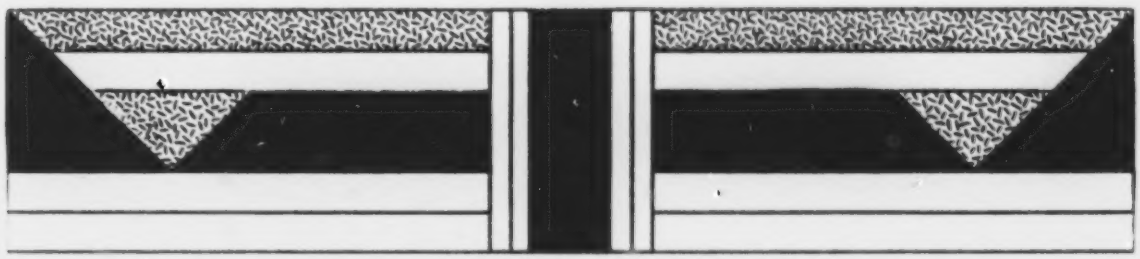
Divide your class into small groups. Give each group a quart can, with both ends removed, and a gallon of water in a bucket or milk jug. The object of this activity is to determine how different soils affect the movement of water. Each group should pick a different area of the campus to do assigned sampling. The can should be pressed about one inch into the soil at the sample site. Next, pour one gallon of water into the can and record the amount of time it takes the water to completely seep into the soil. If watches are not available, one student can roughly count off the seconds. Give each group a question page on which to keep their data. Other questions can be added to this list as the situation warrants.

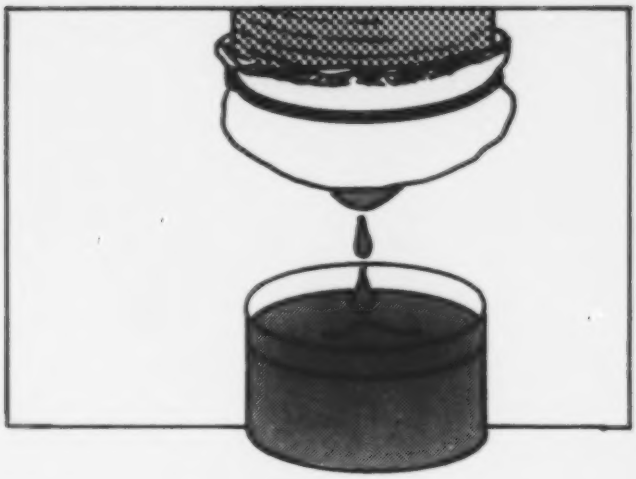
You must teach your children that the ground beneath their feet is the ashes of our grandfathers. So that they will respect the land, tell your children that the earth is rich with the lives of our kin. Teach your children what we have taught our children - that the earth is our mother. Whatever befalls the earth, befalls the sons of the earth. If men spit upon the ground, they spit upon themselves.

This we know. The earth does not belong to man; man belongs to the earth. This we know. All things are connected like the blood which unites one family. All things are connected.

Whatever befalls the earth befalls the sons of the earth. Man did not weave the web of life; he is merely a strand in it. Whatever he does to the web, he does to himself ...

- Chief Seattle





211. SOIL LEACHING AND PERCOLATION

Have your students determine the percolation rate of different soils on the campus. Divide the class into small groups and give each group a large tin can with both ends removed. Attach two or three layers of cheese cloth to one end of each can with rubber bands. Send the students outdoors and have them collect soil samples from different areas of the campus. Fill each can with soil from the sampling areas. Place the soil into the cans so that it is approximately as compacted as it was at the sampling site. The cans should be filled within 2 inches of the top of the can. Hold the cans over clear jars or dishes. Pour three hundred milliliters of water into each can. Keep a record of the number of seconds it takes the 300 ml of water to be absorbed by the soil. Measure the amount of water that ends up in the dishes. Compare the clarity of the residue waters. Which soils allowed the water to pass the fastest? Why? Which residue water was clearest? Why? Examine each sampling site for types of vegetation. How do the leaching effects and percolation limit plant growth.

212. DISSOLVED SOLIDS IN SOILS

Collect soil samples from different parts of the campus. Some samples may be taken from holes dug in the earth. Record the location of each sample. Mix a specific amount of soil with demineralized or distilled water. Filter the soil and water mixture. Allow the filtrate to evaporate or boil it to remove the water. Which soil has the most residue? Can any reasons be given for these results? The procedure can be done quantitatively by accurate measurements of soil, water, and residue if your students wish. Chemistry classes can further analyze the residue qualitatively.

213. SOIL TESTING

Locate an area on campus where the lawn grass is not uniform in color or texture. Divide the class into teams of three or four students per team. Give each team a small paper cup and a tongue depressor. Delineate a study area on the lawn that is approximately 10 to 15 meters on a side. The groups should distribute themselves evenly throughout the study area. One member of the class should make a map of the study area and indicate each group's position. Allow the students to decide on the method of distribution. The map should also include a rough approximation as to where the grass is growing well and where the texture and color do not seem normal. Each group should use its tongue depressor and scoop up three to four teaspoonfuls of soil from the sampling site. If other tests are going to be made, label the tongue depressors and push them into the ground at each sampling spot. Mix distilled water with the soil in each paper cup until the soil is muddy. Give each group a piece of red and blue litmus paper. Place the litmus paper into the mixture and allow to stand for about five minutes. If the red litmus turns blue, then the soil is basic or alkaline. If the blue litmus turns red or pink, the soil is acidic. Now transfer the results and the differences noted in the lawn grass. Was grass at the test sites healthy or unhealthy looking? What could be done to improve the health of the lawn?

214. FERTILIZER STUDY

Place different types of fertilizer on similar small areas of the campus. Compare rates of growth of the plants in these different areas. What elements do the fertilizers have in them? Which fertilizer increased plant growth the most? Was it chemically different? Did any fertilizer decrease plant growth? Be certain to mark each area clearly, and to have control areas without any fertilizer.

215. ESTIMATING ORGANIC MATTER IN THE SOIL

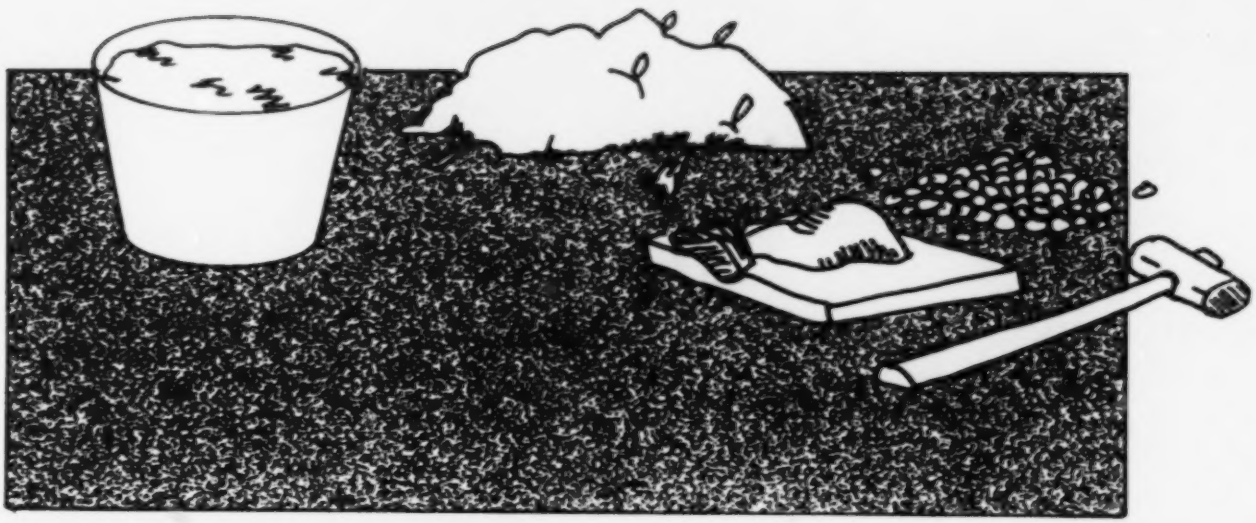
Have your student collect soil samples from different areas of the campus. The sampling sites should contain different types of plants and, if possible, different soil types. Each sample should be approximately 2 cc. Mark the sites on a campus map. Place each soil sample in a test tube. Add approximately 6 ml of 2 NaOH and shake for a few minutes. Allow the mixture to stand for 48 hours in a covered test tube. After the 48 hour period, observe the color of the solution above the soil. If the solution is dark black, the soil is medium in organics, and, if the solution is any other color, the soil has a low organic content. What does organic matter add to the soil that plants need? What types of plants were growing in the low, medium, and high organic content soils? Which soils would hold water the longest? Why?

216. PERCENT OF ORGANIC MATTER IN SOIL

Send groups of students to different parts of the campus and have them collect half a cupful of soil. Weigh each soil sample and record the campus area from which it comes. Also, record the relative abundance of plants at the sample sites. Place the soil samples, one at a time, in a metal pan. Position the pan over a Bunsen burner flame and, using a glass rod, stir the soil sample. This will burn the organic matter out of the soil. (If a kiln is available, place the weighted soil samples in the kiln for 24 hours at 600°. Let the sample cool and then subtract the burned weight from the unburned weight. This will give you the weight of the organic matter. To obtain the percent of organic matter:

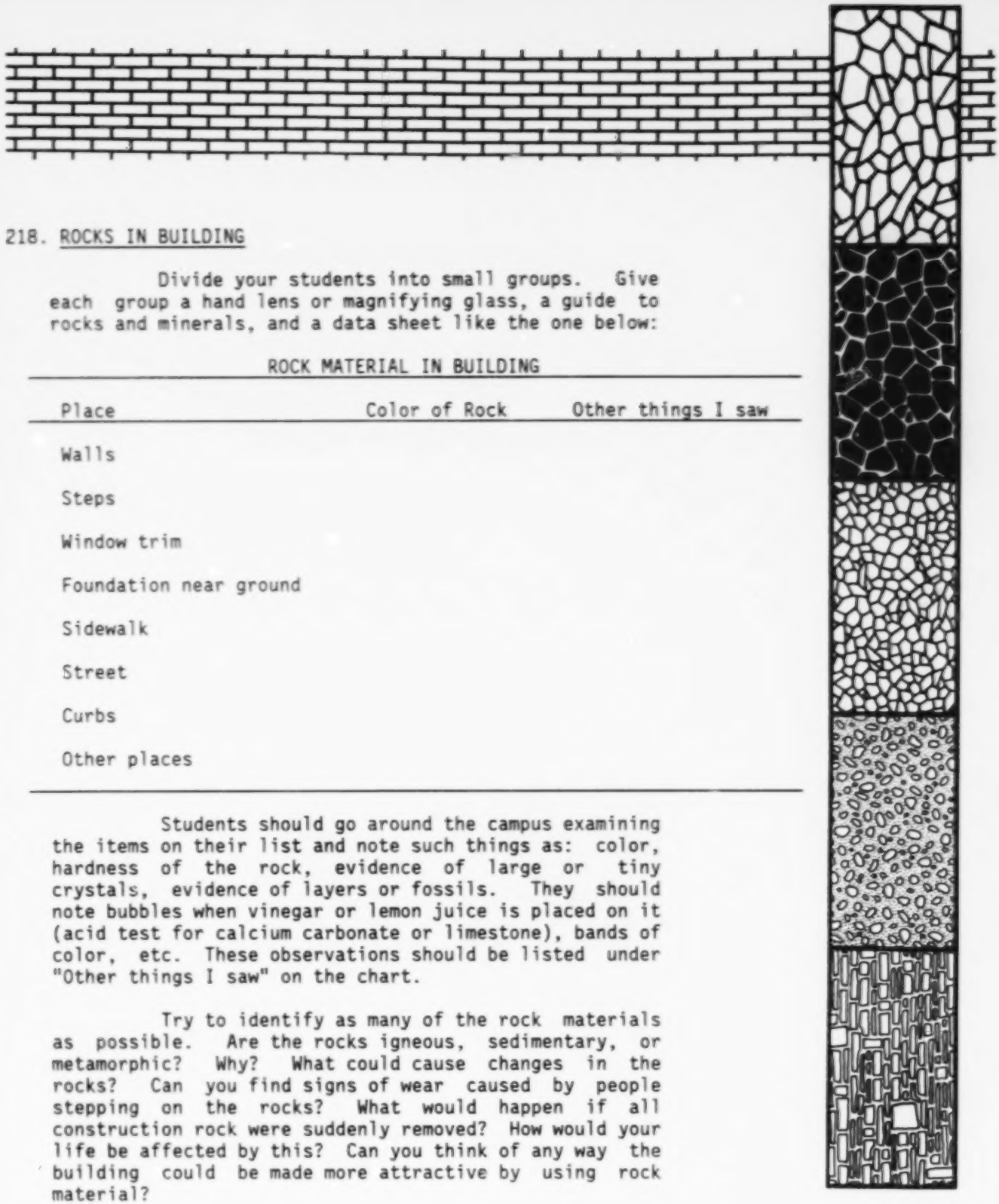
$$\text{Organic Matter} = \frac{\text{Weight difference between burned and unburned}}{\text{Unburned Weight}} \times 100$$

How do the different areas compare? Why do some areas have more organic matter than others? What effect do plants have on the amount of organic matter?



217. MAKE YOUR OWN SOIL

Take your students out on campus and collect a handful of pebbles or other rock fragments. Put the rocks in a cloth bag and pound them to a powder with a hammer. Then compare your "soil" to soil from an area where plants are growing. Examine the soils closely. What is missing from your homemade soil? The bits of decayed leaves and other plant parts add chemicals to the soil that plants need for growth. The decayed plant parts also help hold water in the soil. Mix some of the decayed leaves and twigs with your soil. Put this mixture in a pot and transplant a small plant to the pot. Place a plant in the rocky mixture. Water both plants and place them in a sunny spot. Compare the growth of the plants in the two different soils.



218. ROCKS IN BUILDING

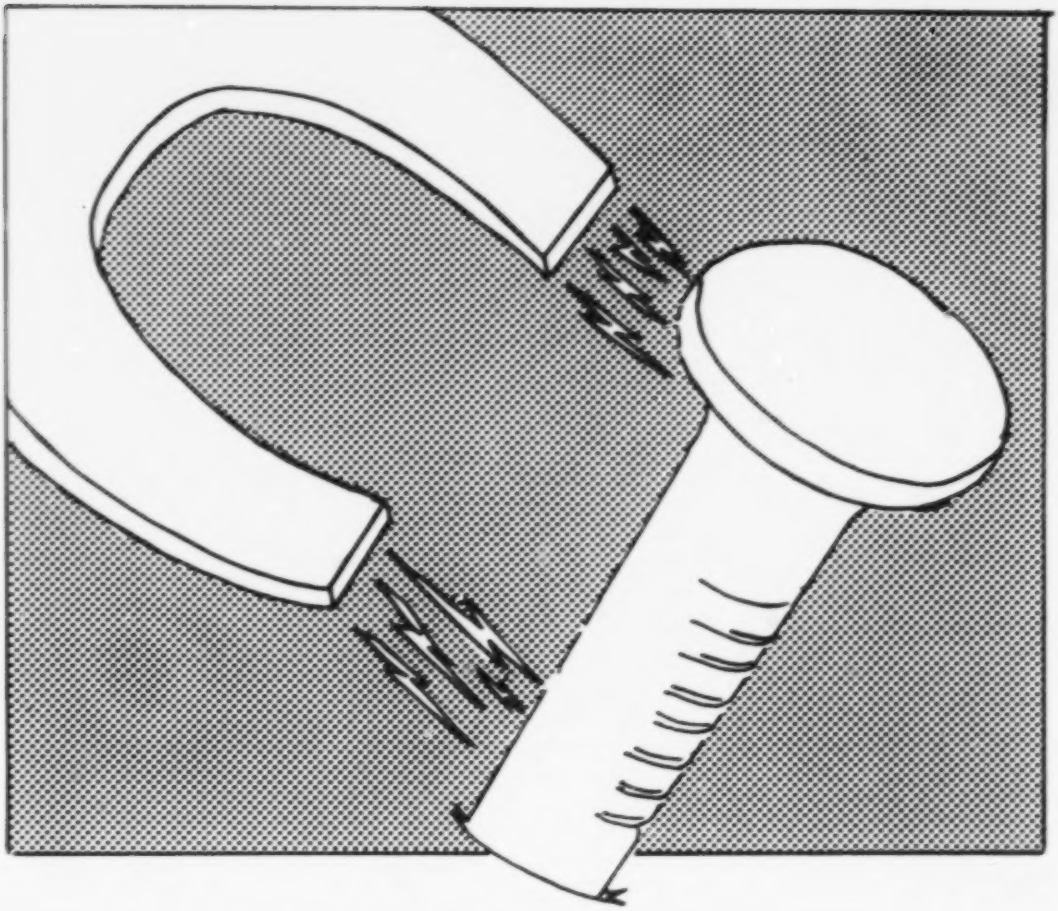
Divide your students into small groups. Give each group a hand lens or magnifying glass, a guide to rocks and minerals, and a data sheet like the one below:

ROCK MATERIAL IN BUILDING

Place	Color of Rock	Other things I saw
Walls		
Steps		
Window trim		
Foundation near ground		
Sidewalk		
Street		
Curbs		
Other places		

Students should go around the campus examining the items on their list and note such things as: color, hardness of the rock, evidence of large or tiny crystals, evidence of layers or fossils. They should note bubbles when vinegar or lemon juice is placed on it (acid test for calcium carbonate or limestone), bands of color, etc. These observations should be listed under "Other things I saw" on the chart.

Try to identify as many of the rock materials as possible. Are the rocks igneous, sedimentary, or metamorphic? Why? What could cause changes in the rocks? Can you find signs of wear caused by people stepping on the rocks? What would happen if all construction rock were suddenly removed? How would your life be affected by this? Can you think of any way the building could be made more attractive by using rock material?

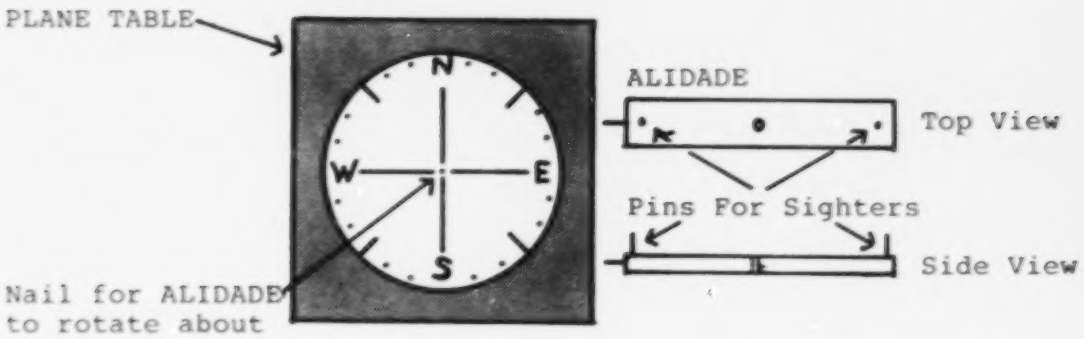


219. CHEMICAL CHANGES

Discuss the meaning and significance of chemical changes while still in the classroom. Then have your students go out on campus and look for evidence of chemical change. If magnets are available, allow students to look for objects made with iron. What is rust? Can a magnet attract rust? What materials can be put on iron to keep it from rusting? Can you still detect the iron underneath these materials? Can you find evidence of oxidation on aluminum materials? What other chemical changes can you find on metals? What caused the changes? Do these changes help or harm the metal? What chemical changes were you able to find on non-metallic things? Were any of these chemical changes caused by living things? Check the materials after a few months and try to determine whether the chemical changes are still proceeding.

220. MAPPING WITH A PLANE TABLE AND ALIDADE

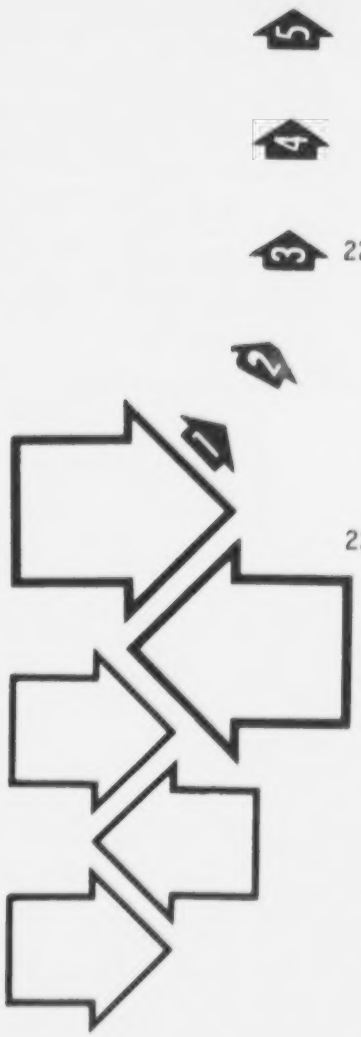
Have your students construct two plane tables and alidades and map the campus. This is a triangulation method of mapping. The plane tables can be constructed from two 2 foot squares of plywood. Draw a compass face on the plywood squares. Delineate the degrees and the compass directions with ink. The alidade is a sighting device that rotates from the center of the plane table. (See drawing below).



Place each plane table and alidade 100 feet apart. Align each table so that the north designation on the table is pointing due north; use a magnetic compass for this. Each table uses the alidade and sites on an object. Record the degrees <u>from</u> north to which the alidades are pointing. Do this for several objects: trees, buildings, edges of ponds, etc. Determine a scale for your map. Set up the scale 100 foot baseline on the paper. Use a protractor and transfer the field degree readings to the map and triangulate the objects mapped.

221. ELEMENTARY CAMPING

Get teachers or parents to donate the use of three or four tents, camp stoves, and other camping equipment. Hold your entire class outdoors for several days. If possible, place the tents in an isolated part of the campus. Have the school cafeteria provide bag lunches or prepare lunch on the spot. Have the students work on campus activities that teach specific curriculum objectives (appropriate activities may be found in this booklet). "Elementary camping" works well with kindergarten through third grade.



222. FIRST AID

After the appropriate introductory lessons, take your students outside and have them collect materials from the campus that could be used for emergency first aid. Have each student or group explain and demonstrate the use of these materials.

223. TRACKING AND TRAIL BLAZING

The teacher should mark a trail across the school grounds or through a nearby wooded lot using several different marking methods:

(1.) Blaze trees with chalk marks.
(2.) Use arrows made of rock on the ground.
(3.) Put sticks in the ground pointing in the proper direction.
(4.) Make piles of rocks or have a stick pointing from pile.

Students test their tracking skills by following the trail with a paper and pencil. The paper should have four columns: (1) Blaze marks; (2) Rock arrows; (3) Sticks in ground; and (4) Rock piles. Students follow the trail individually and keep track of the number of each type of marker they encounter.

Another variation is to attach a single letter to each marker. Students write down letters as they cover the trail. At the end of the trail, they should have an entire message, or they return to find the letters that seem to be missing.

224. SUN AND SHADOWS

The sun's position in the sky may be studied by observing shadows at intervals throughout the day. With chalk or string, outline the shadow of an object at 10 A.M. Return and outline the shadow of the same object at 2 P.M. This may raise questions that involve coming out every hour on the hour the next day. Shadows not only change direction as the relative position of the earth and sun changes; they also change size as the angle of light reaching earth changes.

225. SUNDIAL

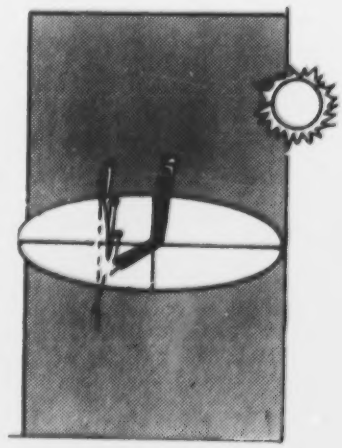
Make a sundial by marking the shadow of a fixed object, such as a flag pole or a stake driven into the ground, every hour. This can be done by driving numbered pegs into the ground or by marking the end of the shadow with stones with the hours marked on them. Check results the next day. It is exactly correct only on the day when it is made. Construct a gnomon (the pointer of a sundial) with an angle equal to the latitude of your school. Point it due north. Set it up and mark the hours.

226. SETTING YOUR WATCH BY THE SUN

Your watch can be set to the approximate time in the wilderness by the use of a compass. Find due south with your compass. Lay your watch on the ground beside the compass. Then, using a pencil or twig, cast a shadow over the watch to keep the hour hand of your watch pointed toward the sun. Turn the hands until south is midway between the shadow and twelve along the shorter arc. Your watch should then be set to within a few minutes of the local standard time.

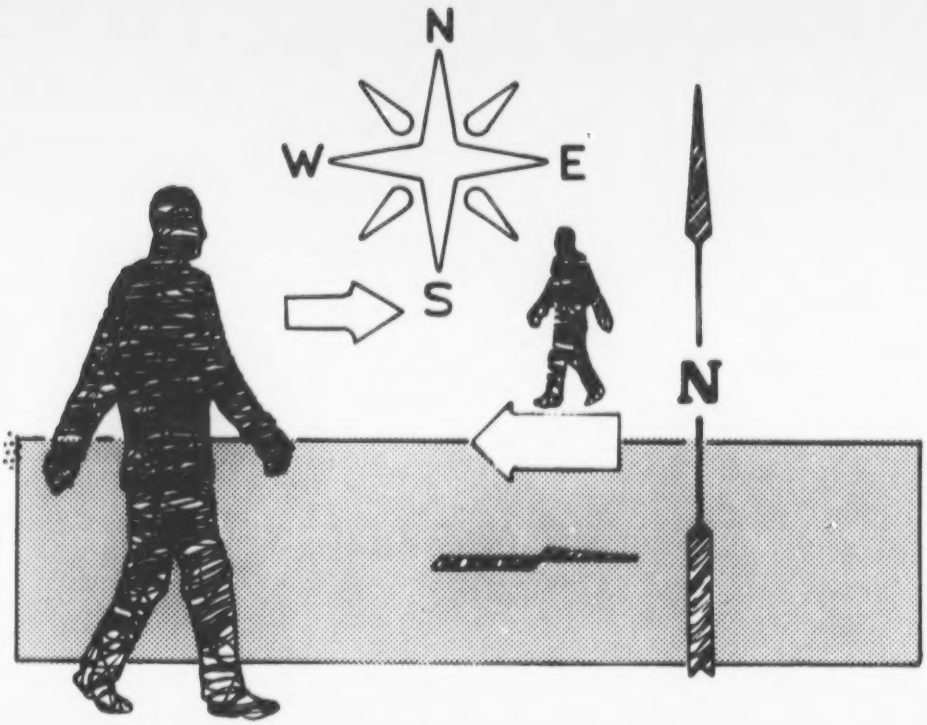
227. FINDING NORTH AND SOUTH WITHOUT A COMPASS

A compass direction can be taken by measuring the points of a shadow from the top of a stick in the ground. Placing a heavy stick or stake in the ground, place a marker (small stick or stone) where the top of the shadow of the stick ends. Every 20 minutes or half hour, mark the new shadow point with another marker. The points will make a curve, once four or more readings have been made.



Next draw a large circle around the post. (A string and marker will assure an accurate circle.) Continue the curve that is indicated from the markers until your curve cuts across the circle. The two points where the curve intersects the circle will give you east and west. Connect east and west points with a straight line. Draw a perpendicular line through this to give you north and south.

Twice a year, while the sun is directly over the equator, March 21 and September 21, or within a week of either side of these days, the shadow will represent itself in a straight line - east and west.

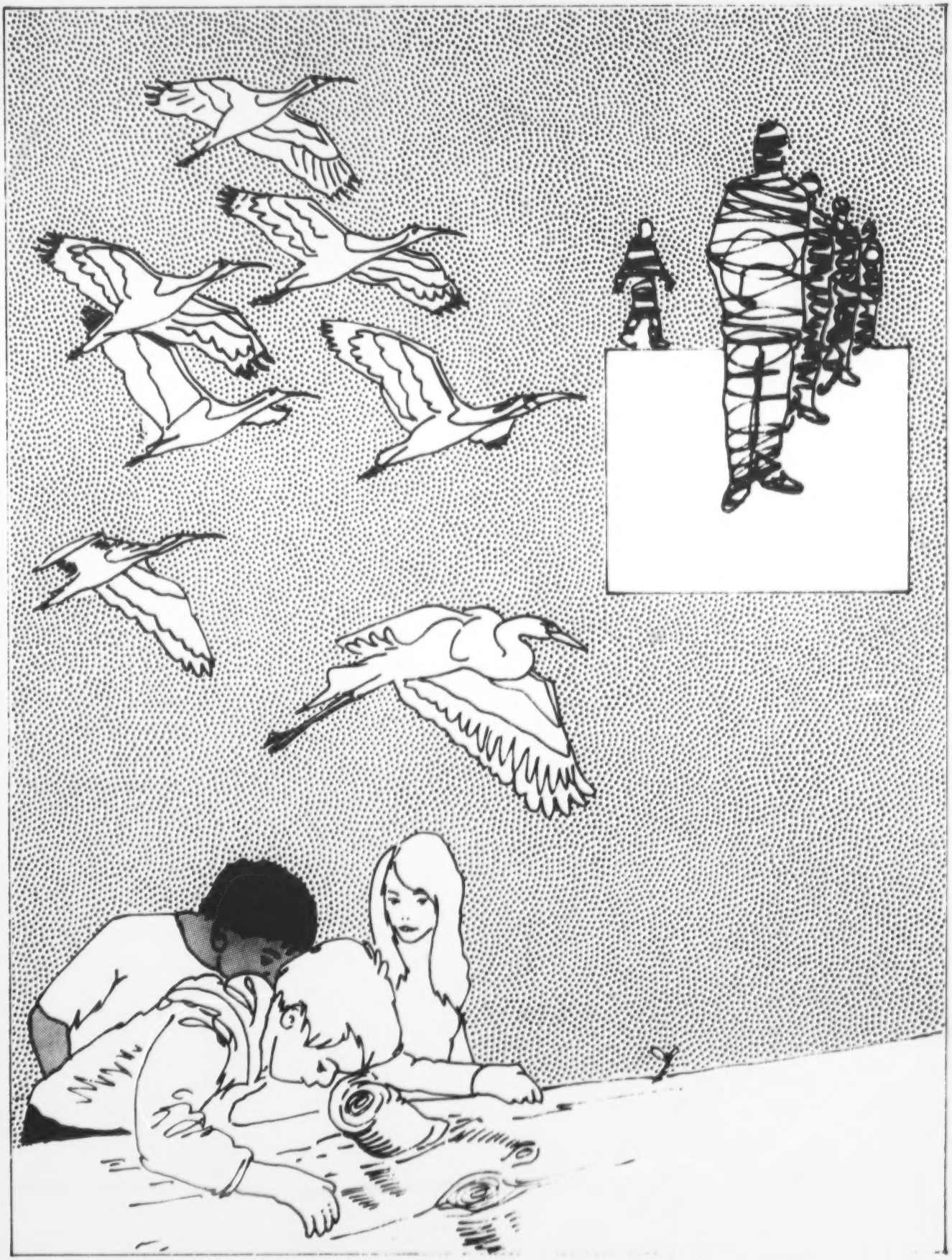


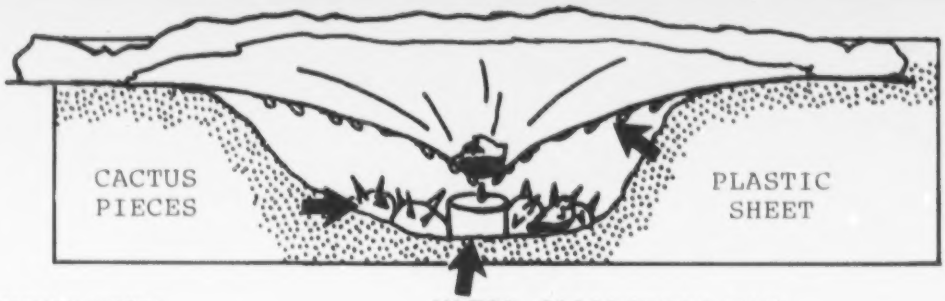
228. TELLING DIRECTION BY THE SHADOW TIP METHOD

When working with the compass and discussing shadows or the movement of the earth, take your students outdoors and show them how to find the points of the compass. Drive a stake vertically into the ground. The stake should be at least 3 feet above the ground. Place a marker at the tip of the shadow cast by the stake. Wait at least 10 minutes, and then place another marker on the spot where the shadow now falls. Draw a line between the two markers. This line will always run east and west. The second marker will be pointing toward the east. North and south can then be determined by facing east; north will be to the person's left.

229. CAMPUS COMPASS TRIP

Prepare a series of compass headings and pace distances that will lead your students to a specific point on the campus. It is best to prepare several alternate routes so that different groups will end up at the same point, but not on the same trail. Give each group of students a compass and the directions for its use. Then give them a copy of the compass headings and distances. Don't tell the groups that they are to end up at the same spot.





230. STORE-BOUGHT NATIVE FOODS

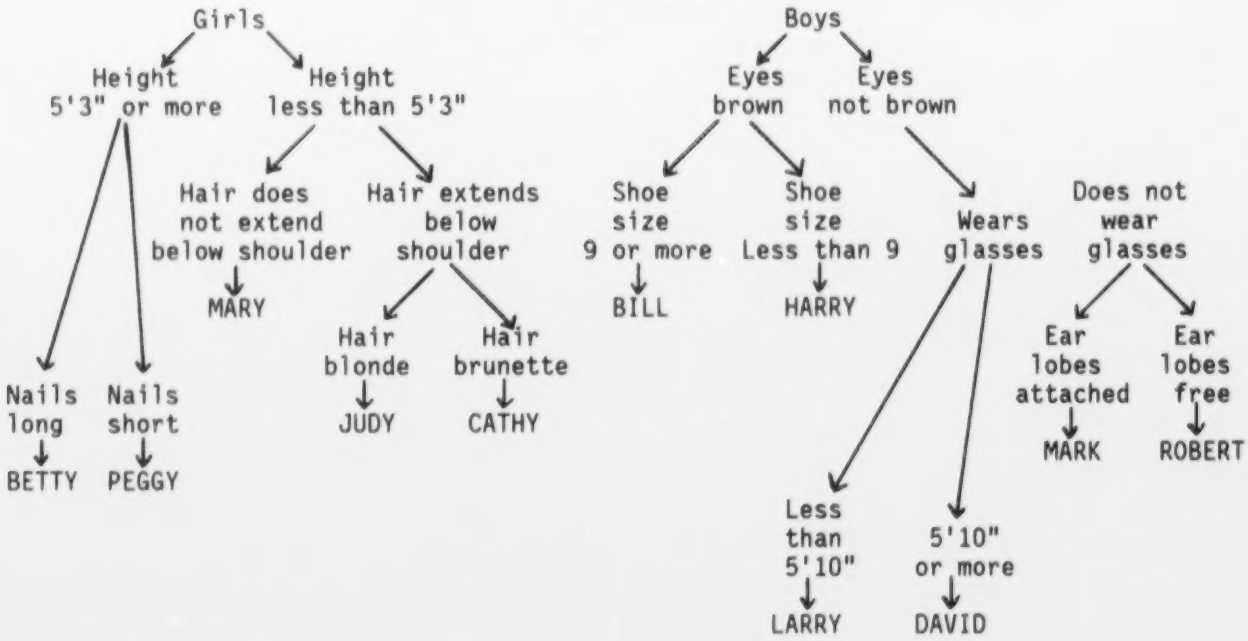
A simple natural food sampling demonstration can be presented to the class, utilizing store-bought native foods. Such items as swamp cabbage, the heart bud of a young cabbage palm, and berries are available in cans from supermarkets. Beef jerky, comb honey, smoked mullet, and other items may all serve to climax a discussion of pioneer foods with the product cut into small sample portions for each individual student. Another related classroom project involves pouring a pint of cream into a quart size bottle. Each student shakes the bottle vigorously and passes it to a neighbor. Make sure the cream is cold. Soon, chunks of butter will float to the top. Spread the butter on crackers for students to sample. Stress the pioneer history of each item and how it was obtained and utilized.

231. A SOLAR STILL FOR COLLECTING WATER

A survival method for collecting water can be demonstrated by using a piece of light plastic sheeting about 4 feet square. Dig a hole about 3 feet across and about 1 1/2 to 2 feet deep in a sunny place (preferably in moist ground). A wet sand area on the beach also works well. If cactus or moisture collecting plants are available, cut them in chunks and place them in the hole. In the bottom of the hole place a collecting receptacle (jar or can). Lay the plastic sheet over the hole and weight edges with stones to seal edges as tightly as possible. Place a stone in the middle on top of the plastic sheet above the approximate center of the receptacle. Moisture from the soil or plants will be drawn up by the heat of the sun. The cooler air above the plastic will result in condensation. The moisture of the condensation will collect and run down the plastic to the lowest point where it drips off into the container. Choose a sunny day for your experiment. One to five pints of water may be collected in a day using this technique. Discuss the water cycle as it relates to this experiment. Condensation, precipitation, and evaporation all occur in this exercise. Why?

232. INTRODUCTION TO KEYS

As an introduction to the use of student-made keys, make a key to the students of the class which can be compared to other types of keys. Use the full length of the chalkboard. Use the style shown below and allow the students to create their own subdivisions. Use the key to identify each student in the class. Frequently used divisions are:



233. SIMPLE CLASSIFICATION

Give each student a piece of paper and a pencil. Assign a 1 or 2 meter area to each student somewhere on the campus. The students should devise an identification key that could be used to classify all things within their study area. Emphasis should be placed on the formation of the key, rather than on phylogenetic classification techniques. Examples might be: living and non-living; green and yellow; smaller than a pea and larger than a pea, etc. Have students exchange keys and try to identify objects. Discuss the usefulness of keys.

234. STUDENT PLANT KEYS

The class is divided into smaller groups. Each group receives a bag of approximately six to ten different plants. (Grasses, weeds, small tree branches, etc.). Students first make up a descriptive name for each plant, e.g., a sea grape leaf may be named, "Pancake Tree". Each group proceeds to develop its own Plant Key to the specimens before them. They find and determine characteristics to divide specimens into groups, and subdivide each group in the same manner until each specimen is followed through to its name. Groups exchange and try each other's key on their own plants.

235. WEB OF LIFE

Discuss the words "interdependence" and "relationships", then send the class out to make a list of all the interesting things they can find on the school grounds that fit the definitions. When students return to the classroom, the names of the objects they have observed are written on the chalkboard. Lines are drawn connecting things that the students feel are related. The pattern resembles a web - the web of life.

236. CAMPUS FOOD WEBS

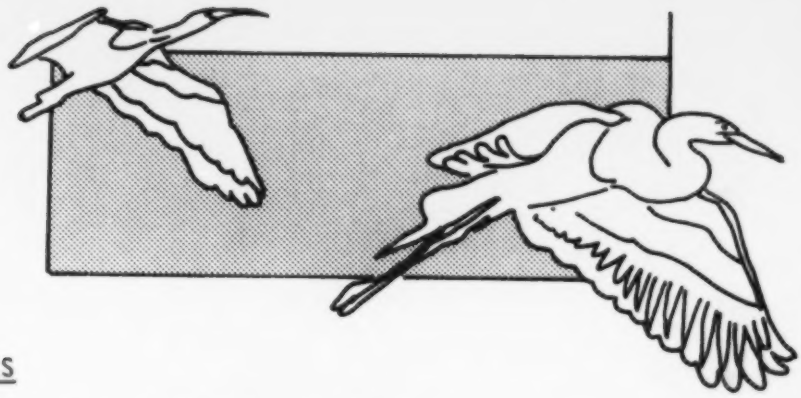
Have students determine the major producers and consumers on the campus. From this information, they should construct a simple campus food web. What could be done to ensure the complexity of the food web and thereby increase its stability? Let the students plan a way to increase the stability of the campus food web.

237. WHO'S EATING WHAT?

Have your class divide into groups of two and then go outdoors. Each group should identify a 1-square-meter area on campus. Students should look for evidence of what animals have been eating in their area. Look for scat, casts, leaves that have been chewed, or any other secondhand proof of an animal's presence. If any living animals are found, students should try to establish the trophic level and the position of the animal in its food web. Do some areas show more evidence than others? Why? Do some plants seem to be used more as a food source than others? Why? How do shaded areas compare to sunny areas?

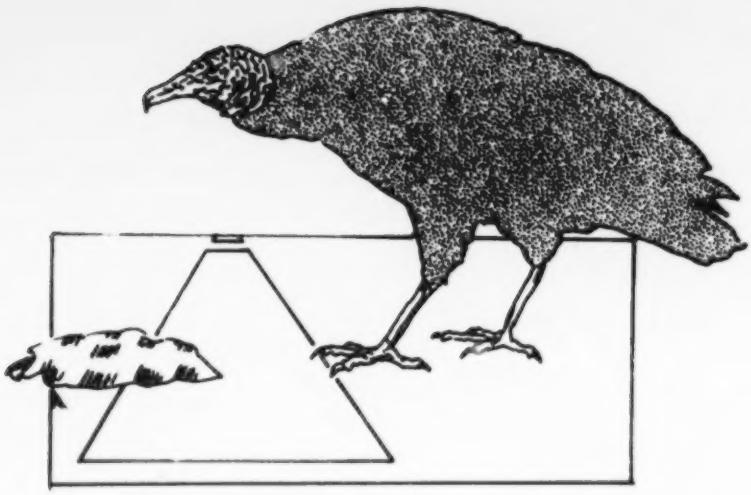
238. BUILDING A FOOD WEB

This activity shows an easy way to communicate to students the interrelationships and interdependence of a food web. Lead students outdoors to a large tree on the school grounds. Choose one student to represent the sun. The "sun" should stand in front with arms raised, giving off sunshine. Next, choose two students to represent a tree (a forked tree if you wish). Emphasize how the tree needs the sunlight. Next, a student should be an airplant. The airplant needs the tree, so the airplant should hold onto the students acting as the tree. An insect (an airplant weevil) should next be chosen. The airplant weevil holds onto the airplant. Next, a tree frog, who eats airplant weevils, holds onto the weevil. A ribbon snake (who eats tree frogs) is chosen to hold onto the frog, which it needs to survive. A red-shouldered hawk can be chosen to feed upon the snake. Returning to the tree, a squirrel can be chosen. It eats buds, acorns, or seeds from the tree. The squirrel should hold onto the tree. A squirrel flea can be chosen to hold onto the squirrel. Bark beetles can also hold the tree. Spiders and woodpeckers can be picked to hold onto the beetle. A wasp, which hunts spiders, can show dependence upon the spider. On and on go the relationships until each student in the class is part of the chain. Emphasize what would happen if the tree disappeared (perhaps by being bull-dozed down to make way for a house). Ask the class what would happen to the snake if the sunlight were reduced (by air pollution) and the tree died. Stress the interrelationships and be dramatic. Many teachers prefer to have the class make posters of the organisms they represent. In acting out the chain, each child displays his poster as a reminder of the role he is playing.



239. A FOOD WEB OF THE MANGROVES

Following the example of the food chain activity, students can comprise a food web of our local bays and estuarine areas. Begin, as always, with a student representing the sun. Choose others as mangrove trees. Next, a student should be chosen to be algae growing on the mangrove roots. Algae bugs (amphipods) eat the algae. Pin fish could eat the algae bugs and snook consume the pin fish. Dolphins, ospreys and a sports fisherman can be chosen to eat the snook. Coon oysters and barnacles should also cling to the mangrove roots. Sheepshead consume the barnacles and oysters. Predators (sharks, dolphins, osprey, sport fishermen) prey upon sheepshead. More students should represent mangrove leaves which have fallen into the water. Tiny microscopic plants and animals (protozoans and fungi) feed on the mangrove leaves. Mullet feed on the leaves to remove the microscopic plants and animals. A commercial fisherman should be chosen now to collect the mullet. Shrimp and blue crabs consume what remains of the mangrove leaves (also eating the microscopic plants and animals). Commercial shrimpers and shell fishermen get the shrimp and crabs. Return to the crab and shrimp. Redfish and yellow-crowned night herons consume the crabs. The redfish, pin fish, and snook eat the shrimp. (Continue this chain as before.) Several restaurant owners depend on the commercial fishermen and should be chosen to cling to each of the commercial fishermen. Visiting tourists from the North depend on the restaurant owner. The hotel owners, store owners, bankers, and other businesspeople are dependent upon the tourists. Fishing tackle salespeople depend on the tourists, many of whom visit to fish for snook, redfish, and sheepshead. Ask students, at this point, if there is an end to the food chain (web) or does it continue. Have students discuss the importance of the mangrove system and all its component parts. What would be affected if the mangroves were removed?

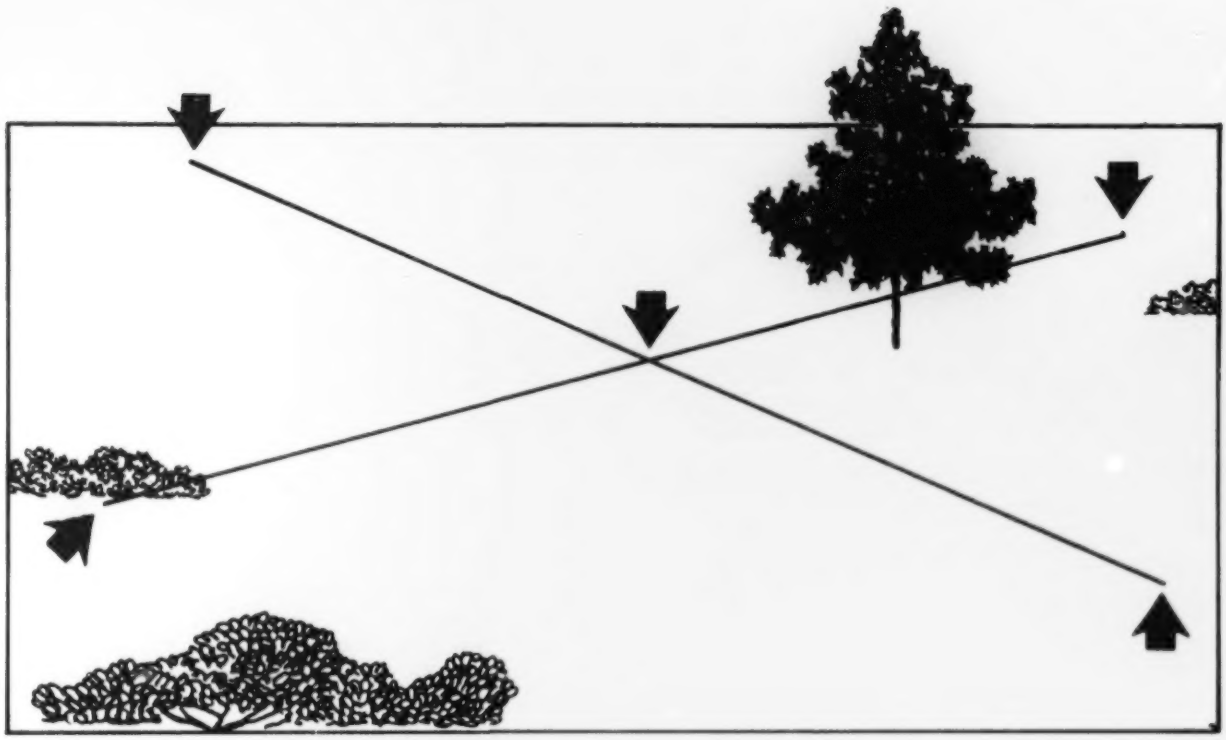


240. PRODUCERS, CONSUMERS, DECOMPOSERS

Divide your class into three large groups. Give each group a few collecting containers. One group is responsible for finding producers (makers); one group for collecting consumers (eaters); and the third group for collecting decomposers (rotters). Give the class 15 to 20 minutes to make the campus collections. At the end of the time period, each group should show what was found. Members of other groups can challenge items on display. Try to construct food webs from the things brought back. Before beginning the exercise, stress proper collecting techniques such as bringing back one leaf from a plant rather than the whole plant, one ant rather than the whole colony, etc. What happens to the campus food web when the producers are removed?

241. DECOMPOSERS

Take your students to a shady spot near the school. There should be some small weeds and grasses in the area. Push a stick about the thickness of a pencil and approximately 10 inches long into the ground. Push an apple onto the stick. The stick will hold the apple so that animals cannot carry it away. Keep a daily record of the changes that take place. How long did it take before the skin was broken or the apple showed signs that animals had chewed on it? When did insects and worms appear? When did the first odors become noticeable? When did fungi appear? How long did it take for the apple to completely disappear? What would happen if there were no decomposers?



242. ESTABLISHING STUDY PLOTS ON THE SCHOOL GROUNDS

Studies on the school grounds will often be more manageable if the study area is subdivided into smaller study plots. A convenient way to choose a random selection of plots is to visualize an X drawn across the middle of the lot. Locate one study plot near the outer end of each leg of the X. Locate the fifth plot at the center of the X where the lines cross. Additional plots can be placed between those already established. The size of the plot will vary according to the type of study you are doing. A 10- foot-square plot can be made by giving students strips of string 40 feet in length. Have students fold the string in half and again fold that portion in half. Tie markers or mark the string with ink on all four extremities. Choosing a plot, the students should stretch the string, with each ink mark defining a corner. Secure a stick in the ground at each corner and attach string with a paper clip. The 10-foot-square plot can be mapped by subdividing the plot into feet. Reproduce plot onto a sheet of paper with a scale of 1 inch equals 1 foot.

243. DICE'S METHOD OF POPULATION ESTIMATION

Dice's method is used to estimate plant populations and sessile animal populations. Locate a study area on campus that contains several varieties of weeds, shrubs, and/or trees. The size of the study area is determined by the type of plant being studied; grass study areas are usually 1 square meter; small shrubs and weeds are 5 square meters; and trees 10 square meters. Once the size of the study area has been determined, place a stake in each corner of the study plot. Next, divide the study area into quadrants (four equal parts). This can be done by using wooden stakes with string stretched between them. Divide each quadrant into several quadrats. Quadrat size depends on the size of the study area. Usually, a 1-square-meter study area has quadrats of 10 centimeter square; a 5-square-meter area has quadrats of approximately 1-square-meter quadrats. A rough map of the study area and the quadrats should be drawn. Number each quadrat on the map. Randomly choose 15 percent of the quadrats. These quadrats become the areas from which counts will be made. Mark each of the randomly chosen quadrats and count the number of the plants under question in these quadrats. Record the total number of plants counted and divide this number by the number of chosen quadrats. This will result in the average number of plants per chosen quadrat. Multiply the average number of plants by the total number of quadrats in the entire study area. This product will be the population estimation for the area. The percent of accuracy can be determined by actually making a direct census of the study plants within the entire area. Density can be determined by using the population estimation and the area of the study plot. Comparisons between plant types can be made by estimating different plant populations. Which plant seems to dominate the area?

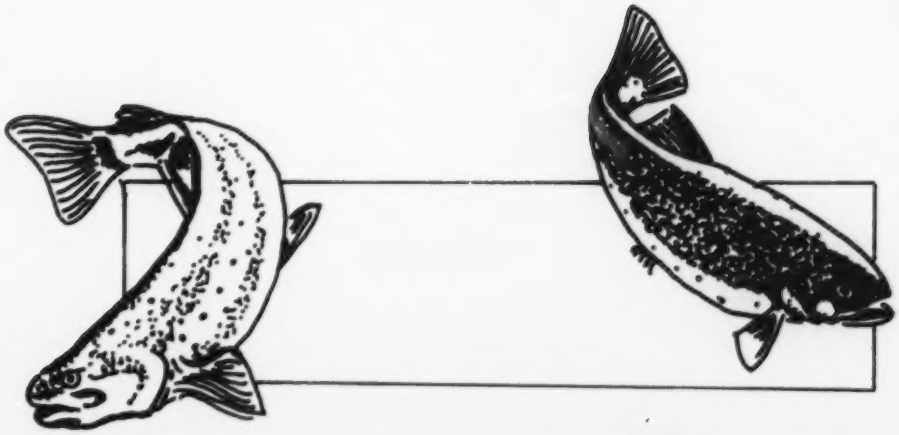
244. POPULATIONS BY TRANSECT

Have your students estimate plant populations by using transects. This activity works best in overgrown areas of the campus such as ditches, the edges of the school grounds, or succession areas. Divide the class into small groups of two or three. Each group should make a rough map of the study area. Give each group a piece of string that is long enough to stretch across the study area. The string is the transect line and should be securely fastened at both ends. The students should move down the transect line and determine which type of plant is most numerous within 2 feet of either side of the string transect. The name of the plant is not important, but, if it can be identified, use the name; otherwise, designate it as plant "A". Record the number of this type of plant along the transect. Do not count grasses. The first transect should be made along one end of the study area. Now move the transect line approximately one-fourth the total distance of the study area from its first position, and repeat the count.

Continue to move the transect line one-fourth the total distance of the study area until four transects have been made through the study area. To obtain an estimate of the total number of the sample plants within the study area, use the following procedure:

1. Determine the total area of the study area; A = length x width.
2. Divide the entire study area by the total area of the transects. (To get the area of one transect, multiply width of 2 feet times the length of the transect.)
3. Determine the average number of the study plants in the four transects; # plants in transect 1 + # plants in 2 + # plants in 3 + # plants in 4 ÷ 4 = _____.
4. Multiply the average number of plants in the four transects by the answer to step #2. This product is the estimate of the total number of plants within the study area.

How did the different groups compare? How would you determine the second and third most abundant plants?



245. FISH POPULATION ESTIMATES

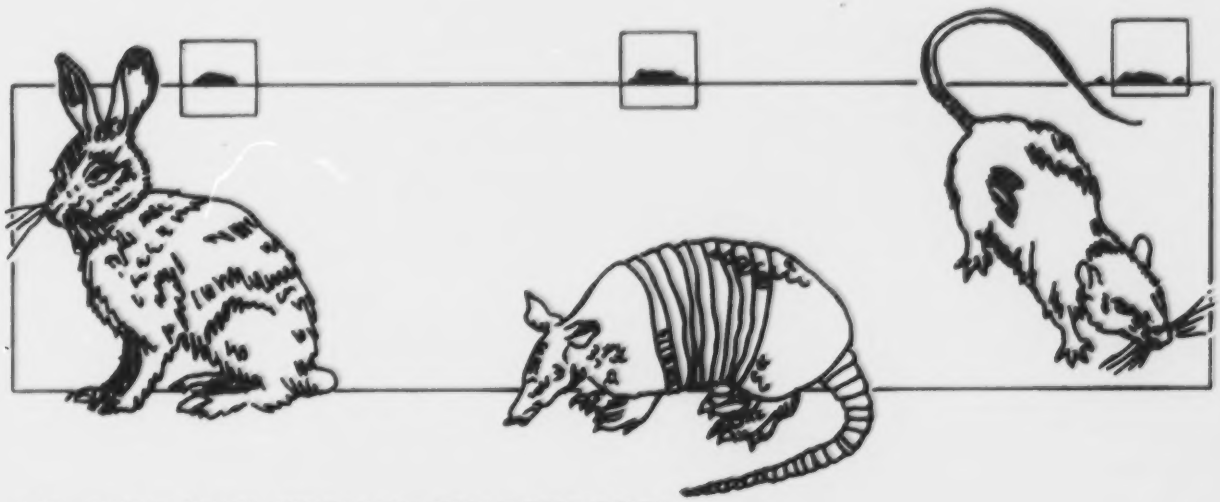
If your campus has a pond or shallow canal, have your students determine the population of fish. You will need a seine net, an aquarium, and portable aerators. Seine the shoreline area of the pond. Once the seine hauls do not produce large numbers of fish, discontinue the capturing. Examine the captured fish in the tank. The different species may be separated. Count each individual, if you wish, to estimate the population of each species; record the data accordingly. Mark each fish by fin clipping or thread marking. (When fin clipping, cut a small "V" shaped notch in the caudal fin. To thread mark, attach a small piece of brightly colored thread to the dorsal fin.)

Return all of the marked individuals to the pond. Wait one day and then repeat the seining activity. Again, place the captured fish in an aquarium. Separate the species, if this was done before. Record the number of new captures and the number of marked fish that were recaptured. To estimate the populations, use the following formula and cross multiply:

Lincoln-Peterson Index:

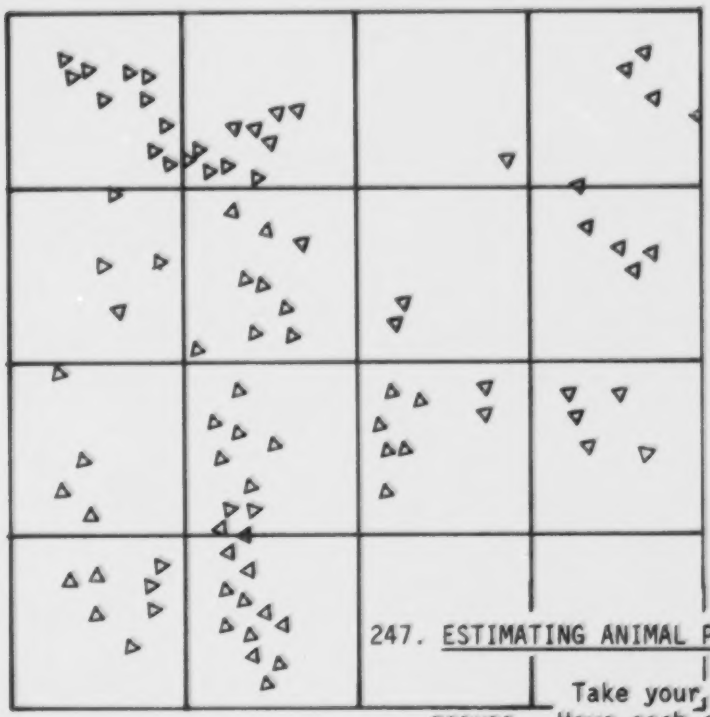
$$\frac{\text{Population Estimate}}{\text{Total Number of Fish Captured on Day One}} = \frac{\text{Total Number of Fish Captured on Day Two}}{\text{Number of Marked Fish Recaptured}}$$

If you are estimating separate species, use the data collected for each species in the formula. Which species is most abundant? Try to find information about the natural history of each species. Why is one species more abundant than others? What problems can you see with this estimating technique?



246. SMALL MAMMAL SCAT BOARD POPULATION STUDY

If your school borders a woodland or a plant community that is distinctly different from the campus grounds, this activity can be used to determine animal movements from one community into another. Place a series of scat boards (a 6 to 12 inch square of plywood or tile used to observe animal droppings) throughout the two communities. The boards should be placed on transects that travel through both communities. Place the boards equi-distant from each other to get a more accurate understanding of animal movement. Set out bait pans (pans with bits of food such as peanut butter and oatmeal) in each community on the transect lines. The bait pans should be placed approximately five meters inside each community on these transect lines. Obtain a small amount of the vital stains, Congo Red and Fast Green. Each community will be represented by a different dye. Mix approximately 3 to 5 grams of Congo Red with one pound of rolled oats and peanut butter bait. Mix the same proportions of rolled oats and peanut butter with the Fast Green dye. The amounts of bait can be increased or decreased according to the size of the study area. Set the scat boards and baited pans along the transect lines after school. Collect the scat from the boards after a 24 hour period. (All scat should be handled with forceps or tongs.) To determine where the animal ate its food, mix the scat with water. The dye color will appear. How far do animals from one community penetrate into another? What does this imply about the competition for food? Did any animals feed in both areas?



247. ESTIMATING ANIMAL POPULATIONS: LINCOLN-PETERSON INDEX

Take your class outdoors and divide into small groups. Have each group mark off a 1-square-meter area. Divide this area into 16 squares, 25 cm X 25 cm. Give each group 200 small objects such as toothpicks, lima beans, peas, pebbles, grains of corn, etc., and a marking pen or crayon. Spread the objects evenly throughout the square meter. Students should now pick out 10% of the smaller squares from which to sample. The choices can be made by picking numbers from a hat. Place numbered pieces of paper in their appropriate squares on the ground. One student should "capture" as many of the "animals" (small objects) as possible from the chosen squares during a one minute time period. Record this number as "Capture One". Mark each of the capture objects with the crayon or pen. Redistribute the marked animals evenly throughout the entire meter area. Next, repick 10% of the smaller squares and place the small pieces of paper into their appropriate squares. Again, carry out the one minute capture technique. Record the number of "animals" captured as "Capture Two". Record separately the number of marked animals in Capture Two as "Re-Captures". Place the data into the following formula and cross multiply to get an estimate of the total population:

$$\frac{\text{Population Estimate}}{\text{Capture One Total}} = \frac{\text{Capture Two Total}}{\text{Re-Captures}}$$

Students can count the total number of animals in the square meter and determine the percentage of error.

248. POPULATION DENSITY

Divide the number of people in your classroom by the number of square feet available. The result will be your classroom population density. (People - square feet of classroom = population density per square foot of the classroom.) Now have students determine, by pacing, the dimensions of your school grounds. Find the school population and compute the density of students per square foot of ground. What would be the density of students per acre?

In the classroom, have students compute the present population density of Lee County: (a) people per square mile and (b) people per square acre. Compute what this density will be 10 years from now. Compare Lee to other regional county densities.

Data: (1987-88 figures - approximate)

Lee Co.	size = 803 square miles,	population = 305,000
Manatee Co.	size = 739 square miles,	population =
Sarasota Co.	size = 587 square miles,	population =
Charlotte Co.	size = 703 square miles,	population =
Collier Co.	size = 2,006 square miles,	population =

249. SPECIES DIVERSITY

There is evidence that the greater the species diversity within a community, the more stable the community will be. Thus, species diversity is an important parameter in any study. Have your students determine the species diversity of different campus areas. Small groups of students can determine the total number of species in a square meter plus the total number of individuals. To calculate the species diversity, use the following formula:

$$\text{Diversity} = \frac{\text{total number of species}}{\text{total number of individuals}}$$

Why is the diversity of some areas less than other areas? What factors are involved?

250. THE SPACE A SPECIES OCCUPIES

Set up a transect line in a school campus area that has a variety of plant types. (If you are not familiar with transects, look in the index for transect activities.) Have your students make a scale community drawing of the transect line. Use meter sticks to determine the area along the transect line that each plant covers. Calculate the total area covered by each plant, the percent of cover by each plant, and the percent of cover for the species. Below is an example of this activity:

SPECIES	METER OF COVER	TOTAL COVER
A	.5 + .5 + .5 + .5 + .5 + .5	3.0
B	.5 + .5 + .5 + .5 + .5 + .5 + .5 + .5 + .5 + .5	5.0
	GRAND TOTAL	8.0

To calculate percent of cover use:

$$\text{Cover} = \frac{\text{Total area covered by one species}}{\text{Total distance of transect}} \times 100 \qquad \text{Cover} = \frac{\text{3 meters (Species A)}}{\text{10m (transect length)}} \times 100 \qquad \text{Cover} = .3 \times 100$$

$$\text{Cover} = 30\%$$

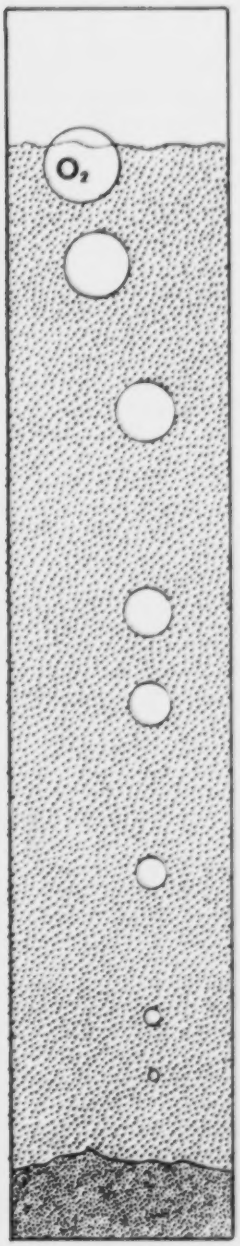
251. PRIMARY PRODUCTIVITY OF TERRESTRIAL HABITATS

Have your students determine the net primary productivity of different areas on campus. This method converts the standing crop, biomass of plants at a given instant, into kilocalories per meter squared, or productivity. (This method does not measure the energy used in metabolism or that lost to consumers.) Have each group of students delineate 3 square meters of the campus with string and stakes. Divide each meter in half. Cut all plant material from the 3-square-meter area, and dispose of the material. Allow the area to stand for two or three weeks. At the end of this period, pick one of the half meter areas and again cut the new growth. Separate this material into grasses and forbs (non-woody plants). Dry this material in a drying oven for 48 hours at 100°C. At one week intervals, cut, separate, and dry the material from a <u>different</u> half meter area. Record the dry weights for each area. Multiply the dry weights by two to obtain the grams of organic matter per meter square (g/m^2). Multiply the g/m^2 by 4.35 to obtain the kilocalories per meter square ($KCal/m^2$). The rate of productivity can be determined by dividing the total number of $KCal/m^2$ by the number of days the plants were growing. Once the $KCal/m^2$/day is determined, multiply by 365 to calculate the $KCal/m^2$/year. Which areas produced the most $KCal/m^2$/year? Try to give reasons for this. You can make comparisons to the following data:

a) upland old field site - 1,360 $KCal/m^2$/year

b) lowland old field site - 4,365 $KCal/m^2$/year

252. AQUATIC PRODUCTIVITY



The primary productivity of an aquatic community is the rate at which energy from the environment is converted into organic compounds by photosynthetic organisms. One method to determine the primary productivity is to measure the oxygen output of the producers (plants). The amount of oxygen produced is used as an index of productivity. If your campus has a pond, lake, or canal, have your students determine the primary productivity of this community. To test for productivity you will need either a commercial dissolved oxygen test kit (Hach or La Motte) or the Winkler materials and apparatus. Take a water sample from the desired location. Test this sample for dissolved oxygen content. Record the results and oxygen content at the start. Next, take two more samples from the same location. Cover one of the sample bottles with aluminum foil so that light cannot penetrate into the bottle. Be certain that both sample bottles are sealed tightly. Suspend the bottles in the pond at the depth from which the samples were taken, for 1 to 24 hours. Remove the bottles and test for oxygen content. Record the results for the bottle kept in the dark with the foil cover and the results from the bottle left in the light. To determine the respiration of a section of the pond:

Respiration = Oxygen content at start minus oxygen content of dark (Oxygen consumed) bottle at end of exercise.

Now calculate the Gross Primary Production by using the following formula:

Gross Primary Production (Total oxygen produced) = Oxygen content of uncovered bottle at end of exercise a minus oxygen content of dark bottle at end of exercise.

Next, calculate the Net Primary Productivity as follows:

Net Primary Productivity (Total oxygen left in system after respiration) = Gross Primary Productivity minus Respiration value

These values (Respiration, Gross and Net Primary Productivity) may be converted from ppm or mg/liter of oxygen to milligrams of carbon per cubic meter by multiplying each value by 375.36. Do different areas of the pond vary? Do different depths vary? Why does covering one test bottle change the amount of O_2 given off? If the entire pond or lake was covered with plants, what would happen to the oxygen level in the water?

253. LEAF UTILIZATION

Green plants produce food by photosynthesis. The food energy stored in the leaves is passed to the next trophic group, the first order consumers, when the leaves are eaten. Have your students calculate the leaf utilization by first order consumers on different parts of the school campus. Mark off a 5 to 10-square-meter area. Identify each major species of plants in the study area. Take 25 living leaves that show signs of being eaten from each species. Look for holes and chewed edges on the leaves. Estimate the percent of each of the leaves that has been eaten away. One way of doing this is by tracing the leaf on graph paper and then estimating the percent that was eaten. Obtain an average for the 25 leaves for each species sampled. This figure is the insect utilization of the plant species. To calculate utilization of the plant materials net productivity, multiply the percent of insect utilization by .27. (The figure, .27, was obtained by scientists working with forest productivity. It was found that the average production of a forest's energy that ended up as leaf material was 27% of the total energy of production.) How do different species of plants compare in their utilization? Do you think these figures would change during different seasons? How does the total utilization for your study area compare with other areas on campus? Can you think of reasons for these differences? To obtain total utilization of net productivity, add the percent utilization for each species in your study area and multiply by .27.

254. CHEMICAL PARAMETERS AND DIATOMS

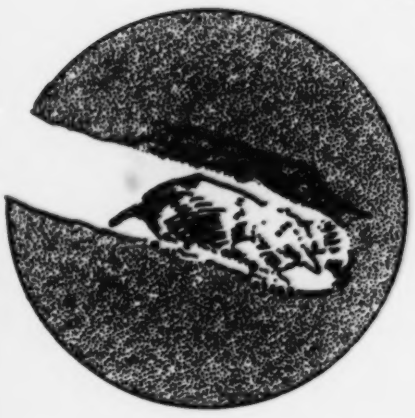
*

Select a canal or pond, on or near the school grounds, and have your class monitor the area for an increase in diatom populations. Once every other day, students should determine the concentrations of phosphates and/or nitrates. Hach or LaMotte test kits should be used for these determinations. A two liter sample of water should also be collected for each chemical sampling day. The chemical data should be recorded and placed in graphic form. The two liter water samples should be passed through a Millipore filter apparatus with a .8 gridded filter. Remove the filter and cut out one of the 4mm X 4mm squares. Carefully place this section of the filter on a microscope slide. Place one or two drops of cedar wood oil on the grid section and cover with a cover slip. The cedar wood oil changes the refractive index of the filter so that the filter cannot be seen. Count the number of diatoms on the filter square. Multiply this number by 108.44 to obtain an estimate of the total number of diatoms in the 2 liter sample. Place this data in a graph. This activity works best after a heavy rain since nutrient runoff usually adds nitrates and phosphates to the water. Was there a population change as the phosphate and/or nitrate levels increased? Why?

*

Walking tours off the schoolgrounds are viewed as field trips and must have principal and parent permission.

255. LIVING THINGS FROM THE GROUND UP



Living things can be found everywhere! Take your class outside and have them look for three things that move in the following places: (a) low places near the ground; (b) places at eye level; and (c) high places over your head.

Discuss the findings and make reports in the form of riddles that give the movement and place. (e.g., I fly and land in trees. What am I?)

256. SUCCESSIONAL STUDY

Following a discussion on the principles of succession, ask students to map the immediate school area and any nearby plant communities. Allow the class to determine, utilizing resourcefulness, the relative age of each successional plant area. Students should work in small independent groups with each group creating its own map, utilizing color codes, cross hatching and combinations thereof to represent ages of various plant stages. Determine which types of plants seem representative for a certain age plant association. (Hints: Maps of overall area should contain roads, buildings, etc.) These zones can be colored gray with pencils. Lawns represent an arrested succession and could be marked in yellow. An abandoned lawn might be less than one year, or a weed patch could be defined and zoned as one to two years, two to three years, three to four years. Seedling trees provide good indicators. A pine area might be 20-25 years or an oak grove more than 100 years, depending on size. (Students should present a logical basis for their hypothesis.)

257. PLANTS AND STUDY PLOTS

This simple activity involves students locating their own 1-foot-square study plot of ground. Space students and be certain that every range of campus plant communities is represented. Students work in pairs. The students place a one-foot-square string or block over their section of ground. Then on hands and knees, they count all the different kinds (species) of plants within their plot. (2, 5, 10, etc.) There is no attention paid to identification, only the number of different plants. Densities, the number of each species per square foot, can also be figured. Compose a color or symbol-coded map of the grounds, demonstrating the various densities of plant species around the school grounds.

258. PLANT COMMUNITIES

Identify within the school grounds and on field teaching sites what appear to be different plant or micro-communities (e.g., a shady tree area, saw palmetto area, a grown-up weed area, a pineland, a canal, a fence row, a wet ditch, an open sandy area, a Brazilian pepper stand, a lawn area, etc.). Divide the class into groups. Each group visits a different micro-community and collects the following data: (a) A collection and list of the seven most abundant plants in the order of their abundance; (b) A collection and list of the seven most abundant insects; (c) A list of as many additional representative plants, animals or objects as each group desires such as fishes or snails, if appropriate; and (d) A written biological description of each community. (A and B should be proven by valid sampling techniques.) Groups should report and defend data before the class. Reasons that account for differences in species distribution and abundance should be discussed.

259. MINI-DESERT

Find an area on campus that is covered with some type of paving material. Parking lots work well. Divide the class into small study groups. Give each group a thermometer and a piece of cardboard. Also, take along a couple of hammers and some large spikes. The spikes should be at least 6 inches long and make a hole big enough for a thermometer. Students should record temperatures within a half-inch of the "desert" floor (paved area) during full sunlight. Next, shade the area for a few minutes and record the shade temperature. Make a hole in the "desert" floor with a spike and record the below ground temperature in full sunlight. Repeat this part of the exercise after shading the area. If possible, make temperature records of the same areas at night. Look for evidence of flash floods on the "desert" (leaves and dirt pushed into ridges or small piles). Repeat the entire exercise in other desert-like areas on campus. How do these areas compare to a grassy lawn or an area under shrubs or trees? Where do you think animals would live on your "desert"? Would the animals be more likely to hunt at night or during the day? Can your desert support any plant life?

260. MANY THINGS TO OBSERVE

Duplicate the following list (or create your own) of things to be observed on the school grounds. Students should work in pairs. Each pair receives a copy of the list. As students search the school grounds making their observations, they should check off the items observed. To follow up, allow students to create a map of the school grounds showing where they found these things.

DRY HABITAT
MOIST HABITAT
SUNNY PLACES
TREES WITH LEAVES
TREES WITH NEEDLES
SHRUBBERY
TREE SEEDLINGS
FLOWERS
GRASSES
BIRDS
INSECTS
SPIDERS
PLANTS IN SIDEWALK CRACKS
DECAY
SICK PLANT
AUTOMOBILES
LITTER
SPLASH EROSION
EFFECTS OF TRAMPLING
INSECT DAMAGE TO PLANTS
AN ANIMAL HOME
PEOPLE
SAND
SIGNS
ANTHILLS

261. ENVIRONMENTAL SURVEY

Have your students plan and carry out a campus survey concerning environmental problems. Divide the class into two groups. One group will survey students, the other group will survey teachers and other adults. Use the following questions plus any questions that the class would like to investigate.

Environmental Survey Form	Yes	No	Maybe
1. Would you be willing to pay higher prices so that industries could install pollution control devices?	___	___	___
2. Do you feel that an industry should absorb the cost of pollution control and not pass it to the consumer?	___	___	___
3. Would you be willing to buy lower quality vegetables and fruit if farmers reduced their use of pesticides?	___	___	___
4. Would you sort the waste materials your family produces such as aluminum, glass, steel, paper, etc., in order to facilitate the ease of recycling?	___	___	___
5. Would you vote for bond issues that would construct efficient sewage disposal systems which would result in higher taxes?	___	___	___
6. Would you buy returnable bottles and cans instead of the no-deposit-no-return type?	___	___	___
7. Would you like to see more of our natural wilderness areas set aside just for the sake of preservation?	___	___	___
8. Where would you be more likely to litter?			
A. In your own yard?	___	___	___
B. One block from your home?	___	___	___
C. Five miles from your home?	___	___	___
D. Never litter.	___	___	___

Students should record the number of Yes, No, and Maybe answers for each question. Determine the percentage of Yes, No, and Maybe answers for each question for both the student and adult groups and compare the percentages of both groups. Discuss each question and the differences involved. To compute percentages:

$$\frac{\text{Total Number answering Yes or No or Maybe}}{\text{Total Number answering the question}} \times 100 = \text{percent}$$

262. WHAT IS THE QUALITY OF YOUR SCHOOL ENVIRONMENT?

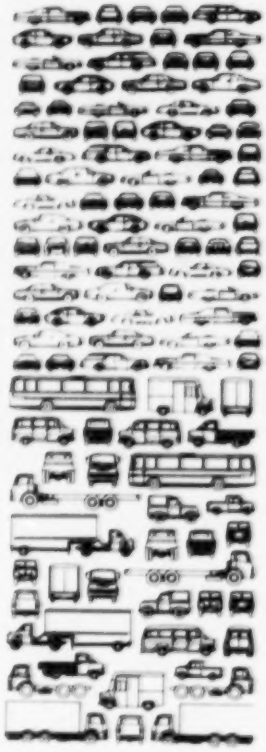
Have students fill out an environmental quality form for their campus. They should prepare a plan of action to remedy any of the bad situations and things they find. Include such things on the form as: Does litter seem sparse or heavy? Where are the areas with the most litter? Should there be more trees and shrubs? What areas need more? Is the school building attractive to the eye? What can be done to improve it? Are there enough sidewalks or have students made "trails" through areas? How can this be remedied? Are there attractive places for students to sit and talk? If not, how and where should these areas be? Are there outdoor study areas for class work? If not, where should they be located, and what kinds of things should be in them? Are there areas that have blowing sand and dirt? What can be done to improve this situation?

263. WILDLIFE INVENTORY

Have your students make a wildlife inventory of the campus. Draw a map of the campus and locate trees, shrubs, and all areas where weeds and other plants are allowed to grow uncontrolled (perhaps the succession area of your landscape). What types of animals can be found in these wildlife areas? Is there any evidence that an area has been cleared of trees? Do the overgrown areas seem to attract wildlife more than the controlled areas such as lawns? Is there any evidence of pollution (smoke, litter, noise, etc.)? What can be done to improve the campus for wildlife? Should new trees and shrubs be planted? Where? How many? What kinds? Prepare a wildlife inventory plan for your campus. To whom should this be presented - the principal, the PTO, the School Board?

264. WHO RIDES TO SCHOOL?

Establish small groups within the class to gather data concerning student transportation. Count the number of cars, motorcycles, and bicycles in the parking lots. Go to the administrative office and ask how many students are transported by buses. From this data, have students determine the percentages of the student body that ride in cars, motorcycles, and buses. If possible, determine the percentage of fuel saved by mass transportation as compared to driving individual cars.



DATA COLLECTION SHEET

What was your location?_____

What was your longest time?_____Shortest?_____

What is the difference between soils?_____

Which soil is better?_____Why?_____

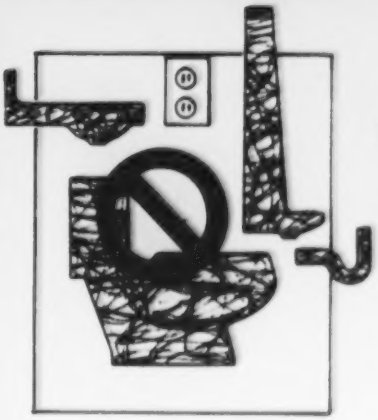
How does man affect this rate?_____

What type of vegetation did you find at:

longest time area?_____

shortest time area?_____

Why were these plants there?_____



265. WHAT HAPPENS WITHOUT UTILITIES

Ask your school principal to turn off the electricity, water, and/or heat for one day. Have your class interview teachers, school workers, and students about their feelings and reactions to what has happened. Try to keep the entire procedure a secret so that reactions will be more natural. Discuss the results of the survey.

266. WHERE DOES IT COME FROM?

Give your students pictures of everyday things such as pencils, bricks, carrots, etc., and have them find an object on campus that could be a source of their picture. Explain that the object does not have to be the actual plant, animal, or non-living thing but something similar. Discuss each picture and campus object. Bring out the idea of limited resources and wise use of our natural resources.

267. LITTER SURVEY

Have your class determine where litter barrels should be placed on the campus. One method of this survey is to have a clean-up day. Pick up all campus litter. Then remove all litter barrels from the campus for two days. Have your students make a litter survey and indicate on a campus map areas containing the most litter. Place the litter barrels in these areas. Clean up any litter that was found at the end of the two day period. Check the campus periodically for new "litter hot-spots" and place barrels in these areas.

268. AIR POLLUTION

Locate the dirtiest air on campus and determine the source of pollution. Then have the students determine methods of cleaning up the air. Take a 3"x 5" index card and punch several holes along one edge with a standard hole-punch. Put a piece of clear cellophane tape over the holes. Place the cards in different areas of the campus and school buildings. The sticky surface of the tape should be facing upwards. Allow the cards to remain in their areas for a few days. Choose a variety of areas - near the building, in open areas, under trees, etc.

269. AUTOMOBILES AND YOUR CAMPUS

Determine the percentage of the school campus that is used by automobiles. Have students determine the total area of the school campus by first measuring their paces and then pacing off the perimeter of the campus. Next, they should determine the areas of parking lots, roads, and any driver education areas. Look for evidence of recent changes taking place on campus in order to accommodate cars. Is the influence of cars increasing or decreasing on the campus?

270. VIDEO TAPE CAMPUS ENVIRONMENT

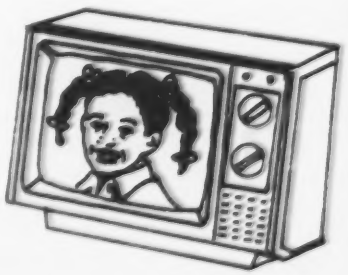
Have your class create a short television presentation that points out campus environmental problems and solutions for these problems. Use the show on the school's closed circuit television network so other classes can participate and learn.

271. POLLUTION POSTERS

Send your students out on campus to find signs of pollution. They should make a poster that illustrates the type of pollution and the location on the campus. The poster can have a rhyming title such as, "Snoopy is droopy because of pollution". Place the posters around the school so that other students can examine them.

272. T.V. COMMERCIAL WRITING

Have each student pick an area on the school campus and write a television commercial showing the value of that area. The commercials can be presented in class and the best ones could be given before and after school assemblies.



273. CAMPUS CONSERVATION

Organize a C.C.C. (Campus Conservation Corps) to encourage individual involvement in conserving materials such as energy and water at school. Have students determine where the worst concentrations of waste are. Who is creating the most waste? Give some type of reward for belonging to the group, perhaps a special film, buttons, caps, or shirts. Have your students create a program to encourage conservation throughout the school.

274. CHANGE FOR THE BETTER

On a rotating basis, select one student each week from your class. These students should identify campus sites that they feel need to be improved. Sketches and/or photographs can be made of the areas before the improvement. The student's job is to improve the campus site which s/he chose. Sketches or photos of the area after the improvements should also be made. A weekly bulletin board can be set up. Students should write a short paper that expresses their feelings concerning what they have done. Frequent check-ups should be made of each improved area. Students should discuss their feelings after these check-ups.

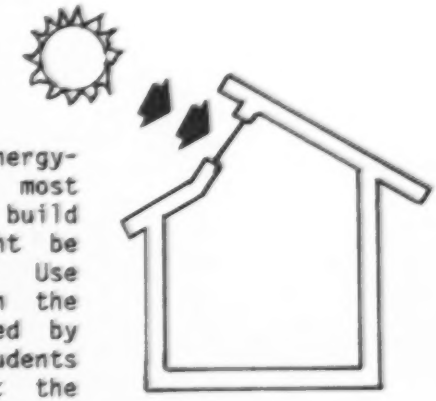
275. HOW DO YOU BUILD A SCHOOL?

Have your students make a list of all the construction materials they can identify in the school building. Allow them to wander around the grounds during this activity. Once the list has been completed, students can determine which materials are manmade and which are not manmade. These lists should be further divided according to industries that supply the materials and states and countries that provide the materials. What would happen to construction if the supply of one of the materials was cut off? What could be substituted? What materials could be used to make the building more attractive?

276. ENVIRONMENTAL PLAYGROUND

Have your high school class design and construct playground equipment from recycled articles for a nearby elementary school. Use old tires, large wire spools or even an old junk car painted bright colors. Tires can be bolted together to form tunnels and other play equipment. When the playground is finished, have the local newspaper write an article on the project with the hope that other schools would use the same recycling concept for playgrounds.

277. ENVIRONMENTAL STRUCTURES



Have your students find out about energy-efficient housing. What types of homes are most efficient in Southwest Florida? Have students build models of energy-efficient homes. The models might be geodesic domes or modular types of construction. Use cardboard, tape, brass paper binders, etc., on the construction. The cardboard can be weather proofed by painting it with varnish or shellac. Let the students use their imaginations but establish one criterion: the designs must fit into a particular environment, such as a mountain, river, or desert habitat. Have other classes examine the models and give reasons for their favorite designs.

278. CAMPUS HEALTH, SAFETY, AND ECOLOGY

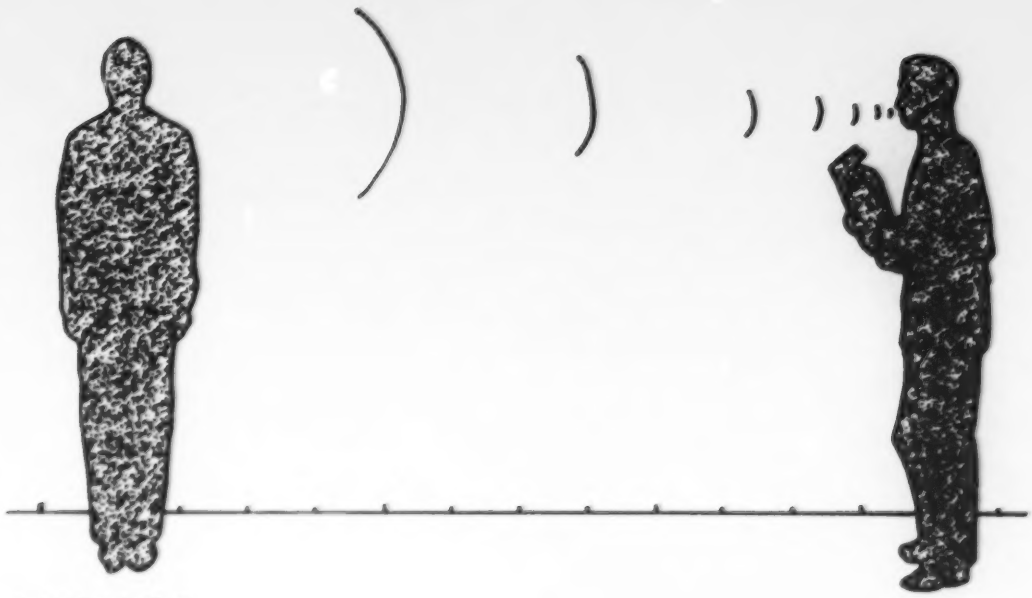
Divide your class into three groups. Each group should be given one of the following topics for research and reports: (1) How can the campus be used to improve the health of students? (2) How can safety be improved on campus? The students should be free to discuss their points of view with other groups. This activity can lead into broader topics such as water, soil, and air.

279. SCHOOL ENVIRONMENTAL SUPPORT SYSTEMS

Have your class examine the school building and campus support systems - water, electricity, oil, sewage, solid waste, food supply, gas, etc. The class should divide into study and research teams, each team concentrating on one or two support systems. The teams should report their findings to the class at the site of the support system, if possible. Next, relate the studied support systems to those found in the community. A bulletin board can be constructed with the names of the systems, using strings to connect interrelated and interdependent systems. What happens when a system is overloaded? Does it affect other systems? What can be done to keep a system from becoming overloaded?

280. CAMPUS NOISE

Have your students use portable tape recorders to make five minute sound recordings from different areas of the campus. The sound level should be set the same at each location. Try to get recordings during different times of the day. Plot the locations on a campus map. Have the class identify the sounds they hear. Are some areas noisier than others? What can be done about the noise in each area? Do the noise levels change during different times of the day? Why? How can shrubs and trees help in softening noise levels?



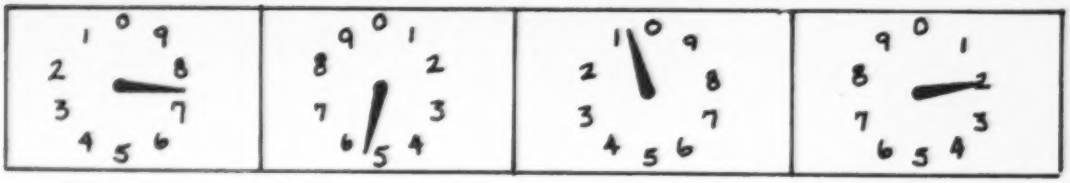
281. NOISE LEVELS

Use the walk-away test to determine the overall noise condition of your school. Divide your class into pairs and give each pair a text book and a data sheet. The data sheet should have the following information: Names in group; time of day; location on campus; noise level from noise chart. To use the walk-away test, one student stands at a fixed location while the other student, starting at a distance of 2 feet, backs slowly away. The student standing at the fixed location should read from the text in a normal speaking voice. It is important that the speaker not raise his voice in order to maintain communication. When the person walking away can only understand a scattered word or two in a ten second period, the listener should stop backing away. Measure the distance between the speaker and listener and compare the distance to the chart below:

Noise Level	Distance Where Understanding Becomes Very Difficult	Noise Acceptability Level
#1	More than 70 feet	Very acceptable
#2	26 - 70 feet	Acceptable
#3	7 - 25 feet	Not very acceptable
#4	Less than 7 feet	Unacceptable

282. ENERGY AND WATER USAGE

Have your students determine the amounts of electricity and water used by their school. Have students locate the water meter and electric meter for the school. Demonstrate the correct method for reading the meters. Always record the number the dial has just passed, for example:



Call the power and water companies to obtain the cost per kilowatt hour and the cost per gallon of water. Make meter readings on Monday morning and repeat readings on Wednesday morning. Determine the amounts used and the cost. Take another set of readings on Friday afternoon and Monday morning. Determine the amounts and cost for the weekend. Compare the two sets of readings. How could the usage be reduced during the week and on weekends?

283. SAVING SCHOOL ELECTRICITY

Have your class determine the number of kilowatt hours of power used by the school in one week's time. Make a survey of outdoor electric uses and classroom uses that could be decreased. After initiating the power savings, again check the school electric meter. How much electricity was saved? Do the same activity at home.

284. THE COST OF LITTER

Studies on maintenance costs along roadsides and parks have shown that it costs more than $.35 to pick up every bottle, can, or piece of paper. Send your class around the school grounds collecting litter. Return and compute how much money your class saved taxpayers.

285. LITTER MEASUREMENT

Ask the students who bring their lunch to school to save all their leftover trash. After lunch, collect all the trash on a table or on the floor in the front of the room. Get the class to help you divide the trash into groups, such as paper products, plastics, foil, bottles and cans, etc. Divide the class into groups and assign each group to a type of trash. Have each group decide on: (1) the origin of the material, (2) other uses for the materials, and (3) ways to recycle the materials. Allow groups to share their decisions.

286. RECYCLING PAPER

Have students collect scrap paper from the campus. Do not keep waxed or plastic coated paper. Tear the paper in very small pieces, the smaller the better. Soak the paper pieces in water for one hour. Beat this mixture with an egg beater until it becomes creamy. Add one tablespoon of cornstarch per gallon of mixture. Pour the mixture through a piece of window screen. Force the mixture through the screen until approximately one-sixteenth of an inch of pulp accumulates. Next set the pulp covered screen on several layers of newspapers. Cover the pulp with a plastic bag and press down. This will force excess water out of the pulp. Replace the newspaper as needed. Allow the fibers to dry for 24 hours and then peel the recycled paper off the screen. Have your class use the paper for art projects or as backing for pressed leaves and flowers.

287. DECOMPOSITION

Early in the year, bury some "typical" garbage, such as glass, bottles, aluminum and steel cans, plastic bottles, cardboard, other forms of paper, food, etc. If possible, take photographs of the items before you bury them. If a camera is not available, make sketches and observation notes. Mark the sites so that they can be found later in the year. Bury each item about 1 foot deep. Near the end of the school year, dig up the materials. Compare the before and after effects of the decomposition on each item. Discuss recycling of resources and the effects of decomposition on plastics and aluminum.

288. WATER POLLUTION AND YOU

Obtain a plastic bucket and dig a hole large enough for the bucket. Fill the bucket with water and you have an instant mini-pond. Have your students observe their pond every few days. In the mornings before school the teacher should drop waste paper, gum, candy wrappers, apple cores, and other assorted bits of trash into the mini-pond. Let your class "discover" the polluted pond. Ask the class to consider how many times each of them has contributed to this kind of pollution. What can be done to stop this? How do they feel about their pond being destroyed by people?

289. TRAFFIC FLOW ANALYSIS

Plan and carry out a traffic analysis survey of the student movement patterns through and around your school. How can these patterns be made more efficient? Do the same for the traffic patterns on the roads around school (intersection analysis). Make a map showing the flow (and amount of flow) of people on the school grounds. Why are there more people in some places than in other places?

SONY
VIDEO
CASSETTE
KCA60
Japan

290. PLACES AND MATERIALS

Search your school and find evidence of as many different countries or states from which materials or products have come, and are now on your campus. Read labels, look at tools, food boxes, etc. How do these products get to South Florida? Could they be made here instead? Why or why not?

291. HOW ARE THINGS USED?

Trace the use of a piece of paper through your school from the time it is delivered to the time it leaves. Do the same for water, electricity. What happens to each item? Could it be used in a more efficient way?

292. ELECTRICAL USE

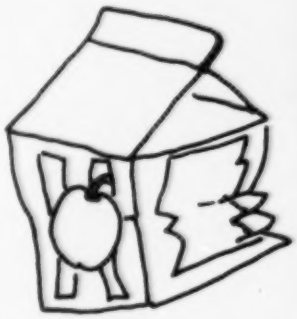
Take a 10-minute campus exploration trip and list as many different ways as possible that electricity is used on your school campus.

293. CAFETERIA COMPOST

Go to the school library and find information on compost piles and composting. Next, visit the school cafeteria and set up special garbage cans for the collection of waste food particles. Obtain permission from the principal to use this food in a compost pile. The soil that is produced can then be used in a school vegetable or flower garden, or the soil can be distributed to elementary schools for garden use.

294. RECYCLING

List three resources on your campus that could be recycled. Organize a program to recycle one of those resources.



295. CAFETERIA FOOD WASTE SURVEY

Estimate the kinds and percentage amounts of food not consumed, but placed in the garbage each day. What measures can you initiate to change this pattern?

296. EFFICIENT SCHOOL LAND USE

Develop a land use plan for your school site. Obtain a survey map of the campus from the principal, or make one. Identify at least one area that could be put to better use by man and develop a plan to make it happen. Identify one area that can be made more productive and develop and implement an improvement plan. Can you develop a plan for improving the aesthetics of your school - landscape, art murals, painted litter barrels, music, etc.?

297. SCHOOL NEIGHBORHOOD LAND USE

Make a land use survey in the neighborhood around your school. What kind of land uses now exist? What kinds of zoning now exist? Where do neighborhood people buy their food, clothes, etc.? What is the road system like? How much of the land is being used to house people? How much land is used to accommodate automobiles and how much green space is there? (An aerial photograph would be helpful.)

298. SCHOOL AND COMMUNITY

Develop a plan for making your school building and site more useful to the neighborhood community around it. How could it be used as a park, recreation site, meeting place, etc.? Present the plan to the principal and School Board and help facilitate the plan.

299. SOLVE A PROBLEM

Identify one problem existing in your school that your class feels is important. Solve the problem! Think of ways to lobby, use advertising techniques, role play, solicit, and attract outside group support. Identify where and what the opposition to solving the problem is.

300. HELPING OTHERS

Have class members select students from a lower grade and lead them in one environmental learning activity on campus.

301. SCHOOL ENERGY MODEL

Make an energy model for your school by showing all the various ways and forms in which energy comes onto your school grounds, all the ways it is used on your school grounds, and all the ways it leaves your school grounds. Does what comes in equal what goes out?

302. HELP THE COMMUNITY

Identify one place within walking distance in the community around your school. Plan and carry out an action to make that area a better place.

303. ENVIRONMENTAL EFFICIENCY

Can you identify one procedure or practice that exists in your school cafeteria that can be changed to save energy or materials?

304. WHO KEEPS THE SCHOOL GOING?

Who are the people who make your school run? Make a school interdependence chart of the role each person working in your school performs, and how those persons are affected by you. Conduct an interview survey of each school employee who is not a teacher to provide information for your chart.

305. CAREERS

Make a search of the school and find evidence of the many different types of occupations that were needed to build and operate the school. Make a careers bulletin board with career cards from the evidence list that students have made. Have students choose an interesting card from the bulletin board and find and interview a person in that career.

306. A LESSON IN SELLING AND ECONOMICS

Divide the class into small groups and choose several small study plots in the lawn, perhaps 2 to 3 feet square. View the content of grasses and weeds purely from the perspective of salesmanship and economics. Students should designate each different type of plant in the plots with a monetary value (from $.01 to $1). The rarest items are typically the most valuable. A showy, attractive weed might have a higher value than a drab, ugly plant. Classes may wish to pretend the plants in the plots are all in demand by greenhouse fanciers, and they simply try to determine the price and value of each. In paper cups, pot one or more of each specimen and place a price tag on it. Later, groups can compare their designated prices. Add additional costs of potting and "pot decoration" to determine your selling price. Have each group develop their own form of advertisement and salesmanship to better sell their products over the competing groups. Each should invent "fancy" names for weeds or grasses to make them sound more attractive to prospective buyers. Invite another class to visit your "sale", or conduct it at a P.T.A. meeting and attempt to sell family members your products.

307. ANIMAL MOVEMENTS WITH A METRONOME

Borrow a metronome from a music teacher. Beginning at a slow rhythm and working toward a faster rythm, have students perform the actions of animals which they feel to be appropriate for each cadence. Slow wing flapping of owls and herons are frequent choices, extending to the rapid cadences of hummingbirds and shrews.

It seems to me that the earth may be borrowed but not bought. It may be used, but not owned. It gives itself in response to love and tending, offers its seasonal flowering and fruiting. But we are tenants and not possessors, lovers and not masters. Cross Creek belongs to the wind and the rain, to the sun and the seasons, to the cosmic secrecy of seed, and beyond all, to time.

- Marjorie Kinnan Rawlings

DEPARTMENT OF ENVIRONMENTAL EDUCATION AND INSTRUCTIONAL DEVELOPMENT SERVICES of Lee County School system:

Bill Hammond . . . . . .Director
Jo Ellen Kessler . . . . . Acting Director
Craig Hortman . . . . . .Resource Teacher
Rick Tully . . . . . .Resource Teacher
Debra Dorsett Hanson . . . . . .Resource Teacher
Keith Hanson . . . . . .Resource Teacher
Neil Wilkinson . . . . . .Resource Teacher
Cindy Bear . . . . . Helping Teacher
George Parker. . . . . Helping Teacher
Eileen Spencer . . . . .Adv. Co. Staff Secretary
Lynette Dean . . . . . Secretary

with special contributions from former EE/IDS staff members, Lee County teachers, district staff, students, and members of the community.

Lee County Schools
Environmental Education/
Instructional Development Services
2055 Central Avenue
Fort Myers, Florida 33901
813-275-3033